CHAPTER III

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

III AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

III.A. INTRODUCTION

III.A.1. Purpose

The purpose of this chapter is to describe the existing conditions in areas that could be affected by implementation of the proposed allocations, and the anticipated environmental consequences that would occur under each alternative. Environmental consequences of the No Action Alternative provide a baseline against which the impacts of the action alternatives are compared.

III.A.2. Assumptions

As mentioned in Chapter I, it was necessary to develop assumptions to establish inputs for the technical studies that were conducted as part of the preparation of this draft EIS. These technical studies, which are included as appendices to this draft EIS, became the basis for predicting the potential environmental impacts associated with each alternative described and addressed in this document. Development of the background assumptions common to all analyses is described in detail in Appendix A. Following is a brief explanation regarding these assumptions and their development, to aid in reading this chapter.

The background assumptions developed for this draft EIS that are common to all analyses are grouped into the following major categories: water availability and pricing; population projections; and land uses. Evaluation of the background assumptions resulted in quantification of water demands of, and water supplies available to, each individual entity for the 50-year study period.

The water availability and pricing assumptions were developed to assess not only the volume of CAP water available by priority class[28], but also the possible price of CAP water. The water availability assumptions included: capacity of the CAP system as a whole; capacity within the CAP system; possible shortages in the Colorado River system; possible surplus Colorado River water available to CAP; and water demands by users of excess CAP water, including AWBA, CAGRD, and NIA districts.

Projected water uses by the individual entities within each use sector (M&I, NIA, and Indian) were developed based upon interviews with Reclamation staff, available data, reports, and institutional constraints (e.g., compliance with the Groundwater Management Act [GMA]). The projected water uses for M&I entities were also based upon the State's regulatory program for water use, including Assured Water Supply (AWS) designations and ADWR management plans. In addition, population projections, entity interviews, and water use plans were analyzed where available (see Appendix C). NIA projected water uses were also based upon an economic analysis conducted by Reclamation (included as Appendix D), cropping patterns, entity interviews, and water supply analyses. As mentioned in Chapter II, Indian users' potential water uses were developed solely for purposes of this document, and are intended only to provide examples of the types of uses for

[28] It is assumed that CAP water would be delivered by priority class. These priority classes are defined in Appendix A.

which these Tribes and communities could use the allocated water. The Tribes themselves will determine the actual uses of water; accordingly, these examples should not be considered binding on the part of any user with regard to developing plans, once water is allocated and contracted. These were prepared using existing water development plans, analysis of existing contracts and agreements, and data provided from Tribes and Reclamation staff. These hypothetical non-binding Tribal projects were developed merely to illustrate the manner in which the Tribes could use the water and to provide, at a programmatic level, a description of the potential impacts that could result from such use. Each entity's projected water use is included in Appendix L.

The projected water uses of each entity were then converted into water budgets[29]. These water budgets became the basis for conducting impact analyses for each affected entity and for evaluating the overall impacts by user sector (M&I, NIA, and Indian).

III.A.3. Resources Evaluated and Structure of Section

The following resources are discussed in this chapter: water; socioeconomic; land; biological; cultural; and air quality.

III.A.3.a. Methodology

Each resource subsection begins with a brief explanation of the impact analysis methodology used to evaluate the impacts for that particular resource area. Specific factors considered to be of particular importance in the evaluation are also identified as appropriate.

III.A.3.b. Affected Environment

A description of the existing conditions within the general project area, for each particular resource, is provided. For all alternatives, this will include the three-County area consisting of Maricopa, Pinal and Pima counties. Specific geographical areas affected by a particular action alternative are also included and described as applicable. (For example, under Non-Settlement Alternatives 2 and 3, existing conditions of areas within the Navajo / Hopi Reservations that could be affected by these alternatives are also described.)

III.A.3.c. Environmental Consequences

Following the description of the affected environment for a given resource there is a summary of the impacts that are anticipated to result to that resource. Impacts occurring as a result of the proposed allocation of CAP water and execution of contracts for the delivery and use of that water can be characterized as either direct or indirect. Direct impacts would be those which are caused by the allocation of CAP water and occur as a direct result of that allocation and contract execution. Examples of these types of impacts include land-disturbing activities associated with construction

[29] A water budget consists of a comparison of an entity's existing and expected water supplies over a given period of time as compared to its expected future water demands over that same period. In the budget, projections are made as to the amounts that will be used from each particular source of water to satisfy the water demands.

of facilities needed to take, treat and deliver CAP water received through this proposed allocation. Indirect impacts would be those that are caused by the allocation and contract execution, but occur later in time or are further removed in distance, but are still reasonably foreseeable. Examples of typical indirect impacts include changes in groundwater levels and cropping patterns due to availability or unavailability (and assumed use or non-use) of CAP water, or due to the varying amount of CAP water made available.

Direct impacts are summarized in this chapter, based upon the status of water user plans for taking and using CAP water that would be received. Most entities have only conceptual plans for taking and using CAP water. Therefore, construction-related activities are discussed at a "programmatic" level. Consistent with long-standing Reclamation practice and previous CAP contracting actions, Reclamation would require completion of specific on-the-ground environmental clearances for any new facilities that would need to be constructed to take delivery of CAP water. Language in the water service contract or subcontract would require that such clearances be completed prior to water delivery. At this time, it is anticipated most entities already using CAP water would not require additional facilities to take and use CAP water received as part of the proposed allocation. Similarly, GRIC and TON already have, or are constructing, facilities for delivery of CAP water, and environmental compliance documents have been, or are being prepared (Franzoy Corey 1988, Reclamation 1997, Reclamation 1999). In other situations, such as the SC Apache Tribe, which has not yet taken delivery of CAP water or constructed facilities, additional environmental compliance documentation would be required, once specific plans for taking and using CAP water are identified (see Chapter V). Once actual plans are received, they would be compared against what is described in Appendix L to determine what, if any, additional evaluation and documentation are needed to complete NEPA clearances. Reclamation is ultimately responsible for ensuring all environmental clearances have been completed satisfactorily, although the on-the-ground surveys and documentation can be prepared by others.

The vast majority of the environmental impacts described in this document are considered to be indirect impacts. Except for specific on-the-ground disturbances from construction of facilities to treat and deliver CAP water, most of the environmental impacts of the proposed allocation will become apparent only over time. These impacts will occur as a result of choices made by water users due to the availability or unavailability of CAP and other sources of water.

As explained in more detail in Appendix C, analysis of current and potential future water resources compared to projected future water demands concluded all M&I entities evaluated in the draft EIS could meet their projected demands without receiving additional CAP water through this proposed allocation (see Appendix C). In other words, urban growth would not be an indirect impact of the proposed allocation, because it would occur even in the absence of the proposed allocation.

Even though the analysis concludes allocation of CAP water would not have an effect on urban growth, the draft EIS identifies and describes land use changes associated with urban growth, and generally describes environmental effects to the various resources, as part of the environmental consequences under the No Action Alternative.

To support the impact analyses presented in this chapter, technical studies were completed for the following resources: water (groundwater); socioeconomic; biological; cultural; and air quality (Appendices I, D, E, G and H, respectively). These studies contain qualitative and/or quantitative data on the affected environmental and analytical procedures used to determine and describe impacts. Due to the nature and extent of the assumptions needed to be made to conduct these studies, the analyses provide more value as a comparison of each action alternative to the others and to the No Action Alternative's baseline, rather than as a prediction of actual changes that would occur within a particular resource area.

A discussion of the regulatory setting that is applicable to the resource areas is included in Chapter IV.

III.A.3.d. Other Resources

Other resource areas, which are typically included in a NEPA analysis include: Geology and Soils; Recreation; Traffic and Transportation; Noise; Public Health and Safety; and Hazardous Materials. These resources areas would not be directly affected as a result of the CAP allocation. No further analysis of these resource areas is included in the draft EIS.

III.B. WATER RESOURCES

III.B.1. Introduction

The water resources affected environment considers both groundwater resources in aquifers which underlie CAP recipients and the effluent resources that may be impacted by alternative CAP allocations. Where appropriate, impacts to the Colorado River downstream of Glen Canyon Dam were considered. The groundwater conditions consider groundwater levels and quality. Also, because subsidence in the area of interest has been related to groundwater withdrawals, consideration of this element of the affected environment is considered together with the water resources. Figures 6, 7, and 8 of Chapter II show the location of the entities that may be impacted by the alternatives.

This section first summarizes the methodology for the water resources impact analysis. The existing conditions in the project area are then discussed. This is followed by discussion of conditions expected to occur under the No Action Alternative and the action alternatives. The discussion of conditions under the alternatives includes an introductory discussion of the primary aspects of the alternatives that result in relevant impacts. Additional detail on this analysis is presented in Appendix I, and the results of the analysis by entity are presented in Appendix L.

III.B.2. Impact Analysis Methodology

Impacts for the alternatives are defined as the change from conditions under the No Action Alternative. Methodologies were developed to analyze impacts with respect to groundwater levels, groundwater quality, surface water levels, and subsidence. Those methodologies are briefly discussed in the following subsections, and are considered in additional detail in Appendix I.

III.B.2.a. Groundwater Level Impact Analysis Methodology

In this analysis, groundwater level impacts are defined as the difference between levels that would occur under the No Action Alternative and the levels that would occur under each of the other alternatives. Changes in groundwater levels may also result in impacts to other resource areas. For example, there may be impacts on economics and land use due to changes in groundwater pumping costs. These related impacts are addressed within discussion of these other resource areas.

The groundwater level impact analysis methodology includes the evaluation of the groundwater hydrologic inventory, and estimation of future water demands and supplies which serve as inputs to the hydrologic inventory. These two elements of the groundwater level impact analysis are discussed in the subsections that follow.

III.B.2.a.(1) Groundwater Hydrologic Inventory

The basic approach to evaluate groundwater level impacts is the consideration of the hydrologic inventory, which involves quantifying the components of recharge to and discharge from groundwater, to determine the change in groundwater storage. This change in groundwater storage can then be used to estimate the associated change in the groundwater level, based on the area under consideration and the storage characteristics of the aquifer. The hydrologic inventory analyses were checked by comparing historical groundwater levels estimated using the hydrologic inventories to observed historical groundwater levels.

III.B.2.a.(2) Estimation of Inputs to Groundwater Hydrologic Inventory

Inputs for the hydrologic inventory models included projections of groundwater pumping and recharge in yearly increments for the 50-year study period. Estimation of inputs varied by use (M&I or agricultural) and geographic area. Inputs for the M&I dominated areas were based on their projected demands and the water supplies either currently available or estimated to be available. Appendices A and C include a more detailed discussion of M&I demand projections. Estimates were made regarding groundwater pumping and the incidental return to groundwater from all water uses. The volumes of direct groundwater recharge were also estimated on a facility-by-facility basis. Inputs for Indian agricultural areas were estimated based on their projected system build-out schedules (see Appendix A). In the NIA dominated areas, inputs were developed based on irrigated acreage. As acreage in the NIA sector would not increase, demands were modified based on decreases in acreage due to urbanization and land going fallow due to farming economics. A more thorough discussion of the inputs to the groundwater hydrologic inventory models is included in Appendix I.

III.B.2.b. Groundwater Quality Impact Analysis Methodology

Groundwater quality impacts were evaluated on a qualitative basis. Factors considered in the qualitative evaluation were:

- Lowering of groundwater levels in areas where poorer quality water may occur at depth;
- Changes in the flow patterns and the potential lateral movement of bodies of poorer quality water; and
- Changes in aquifer salinity due to artificial recharge of CAP water. The concentration of total dissolved solids (TDS) was used as an indicator of the general quality of groundwater. Generally speaking the higher the TDS, the poorer the water quality.

The estimated groundwater level impacts for the alternatives provide the basis to identify the potential impacts due to lowering of groundwater levels into deeper pockets of poorer quality water, and potential changes in the lateral movement of bodies of poorer quality groundwater.

III.B.2.c. Subsidence Impact Analysis Methodology

Subsidence in the areas of interest in this study has generally been due to the compaction of fine-grained materials in the underlying aquifers related to lowering of groundwater levels. A qualitative assessment of the potential for subsidence impacts was made by comparing areas with projected groundwater level declines to the historical occurrence of subsidence in those areas. The qualitative evaluation also considers the geology of the underlying deposits, and their potential for subsidence.

III.B.2.d. Effluent Impacts Analysis Methodology

An analysis of the volume of treated effluent discharged to streams was conducted to determine if an M&I entity not receiving a proposed CAP allocation would cause a decrease (when compared to year 2001 levels) in effluent discharge to streams.

III.B.2.e. Mainstem Impacts Analysis Methodology

The differences in Colorado River water surface elevation between Glen Canyon and Hoover Dams due to proposed CAP allocations and resultant diversion in this stretch was estimated using Manning's Equation and assumptions regarding channel characteristics and flow. Appendix J describes the analysis.

III.B.3. Affected Environment

The existing conditions relevant to groundwater include the geology, the occurrence and movement of groundwater, and a conceptual-level presentation of the elements of the hydrologic inventory. These considerations are summarized in this section, and are presented in further detail in Appendix I. The discussion presented below has been organized into some larger geographic areas, which correspond to the geographic scope of various analyses prepared as shown on Figure III-1.

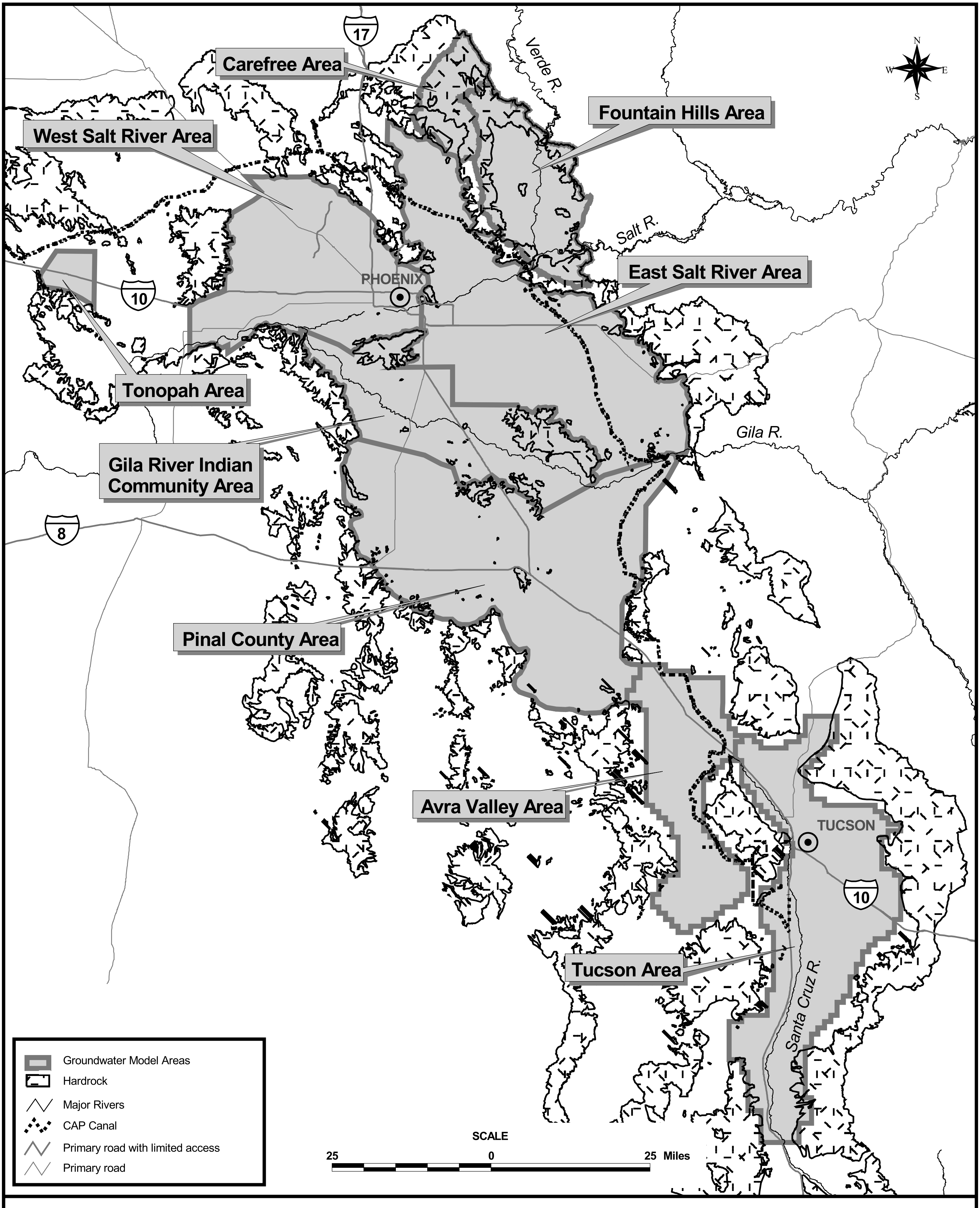
III.B.3.a. Pinal/Salt River Valley

This area includes the basin fill materials in the interconnected Maricopa-Stanfield and Eloy sub-basins of the Pinal Active Management Area (AMA), GRIC, and the East and West Salt River Valley. The valley fill materials fall into three general units. The lower conglomerate unit consists of conglomerate and gravel at the basin margins, and grades into finer deposits toward the center of the basins. The Middle Fine-Grained Unit consists of fine interbedded sands and silty clay in the upper portions, and evaporites with some clay and silt in the lower sections. The Upper Alluvial Unit is composed of alluvial materials that tend to become finer-grained toward the centers of the valleys and in the deeper portions of this unit. The lower conglomerate and Middle Fine-Grained Units tend to become thicker toward the valley axes, while the upper alluvium has a more constant thickness of about 200 to 400 feet throughout.

Groundwater occurs under unconfined to semiconfined conditions in the Upper Alluvial Unit, while the Middle Fine-Grained Unit will often provide confinement to the underlying lower conglomerate and to coarser deposits within the Middle Fine-Grained Unit. Consistent with the trend to fine-grained materials toward the center of the basins, confined conditions are less likely to occur at a given depth at the margins of the basins.

The current pattern of groundwater flow reflects the impacts of development, as a number of groundwater depressions have formed in response to groundwater pumping. These depressions include those which occur beneath the MSIDD, the southern portion of Scottsdale, at the southern end of the East Salt River Valley area against the San Tan Mountains, and in the Luke Cone area of the West Salt River Valley.

Present groundwater levels reflect lowering of groundwater levels over time in response to changes in groundwater use due to development, both for irrigated agriculture and for M&I demands.



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General Location of Groundwater Model Areas

Figure III-1

Recharge to the aquifer includes mountain front recharge, seepage from the Salt and Gila Rivers, groundwater underflow from lands adjacent to the study area, and incidental recharge derived from water applications and use (including significant amounts of Salt, Gila, and Agua Fria water). The large direct recharge facilities in the East Salt River Valley, Granite Reef Underground Storage Project (GRUSP), and the West Salt River Valley (such as the Agua Fria recharge project) will in the future have substantial influence on groundwater levels. Discharge is primarily by groundwater pumping, with some groundwater outflow near Buckeye and some phreatophyte consumptive use.

In the Pinal County area, groundwater below a depth of 1,000 feet has been reserved for future M&I uses. In the Phoenix AMA, the stated goal of groundwater management is to achieve safe yield.

The concentration of TDS was used as an indicator of the general quality of groundwater. TDS concentrations in groundwater generally increase from the margins of the valleys to the central portions of the valleys, and from the upstream areas to the downstream areas along the major drainages. These concentrations range from less than 500 parts per million (ppm) to over 3,000 ppm of TDS. In addition to these area variations in groundwater quality, a body of relatively poor quality water (with a TDS concentration from 1,000 to over 3,000 ppm) also occurs at depths greater than about 500 to 700 feet in the West Salt River Valley northerly of the Gila River and westerly of the Agua Fria River.

Much of the Pinal and Salt River Valley areas have historically experienced subsidence and fissuring. The subsidence impacts tend to be greatest in areas with the most substantial lowering of groundwater levels.

III.B.3.b. Avra Valley

This area includes the basin fill materials in the Avra Valley. These materials lie between the Tucson and Tortolita Mountains to the east and the Silverbell and Roskruge Mountains to the west. The basin fill includes an upper and lower unit. The upper unit consists of gravel, sand, and clayey silt, which ranges in thickness from 100 to 1000 feet. The lower unit can be thousands of feet thick in the central portions of the basin. It consists of gravel and conglomerate at basin margins and in the southern part of the basin. Evaporites, clayey silt, and mudstone occur in the north-central part of the basin. In general, these deposits are coarser along the edges of the basins, and finer-grained toward the central axis of the valley.

Groundwater in the upper 1,000 feet of the basin fill generally occurs under unconfined conditions. Groundwater flow is generally from south to north in the Avra Valley toward the Santa Cruz River. Groundwater flow beneath the River generally parallels the River channel. Present groundwater levels reflect lowering of groundwater levels over time in response to changes in groundwater use due to development, primarily of irrigated agriculture. Recharge to the aquifer includes mountain front recharge, seepage from the Santa Cruz River channel, groundwater underflow from the southern end of the analysis area, and incidental recharge derived from water applications and use. Discharge is primarily by groundwater pumping, with some groundwater outflow to the Avra Valley and some phreatophyte consumptive use.

Most groundwater in Avra Valley has TDS concentrations of less than 500 ppm. There are higher concentrations (in the range of 500 to 1,000 ppm beneath portions of the Santa Cruz River and in areas northeasterly of the Santa Cruz River.

Subsidence has historically occurred in the northern Avra Valley. In addition, the USGS identified the potential for subsidence in much of the northern Avra Valley.

III.B.3.c. Tucson Area

This area includes the basin fill materials along the Santa Cruz River from Tubac in the south, up to the Avra Valley. These materials lie between the Santa Catalina and Santa Rita mountains to the east and the Tucson, Sierrita, and Tumacacori Mountains to the west. The basin fill includes an upper and lower unit. The upper unit consists of gravel, sand, and clayey silt, which ranges in thickness from 100 to 1000 feet. The lower unit consists of gravel, conglomerate, evaporites, clayey silt, and mudstone, and can be thousands of feet thick in the central portions of the valley. In general, these deposits are coarser along the edges of the basins, and finer-grained toward the central axis of the valley.

Groundwater generally occurs under unconfined to partially confined conditions to a depth of about 1,500 feet. Groundwater flow is generally from south to north under the Santa Cruz River, paralleling flow in the river. In the margins of the valley, groundwater generally flows from the mountain fronts toward the Santa Cruz River.

Present groundwater levels reflect lowering of groundwater levels over time in response to changes in groundwater use due to development. Recharge to the aquifer includes mountain front recharge, seepage from the Santa Cruz River channel, groundwater underflow from the southern end of the analysis area, and incidental recharge derived from water applications and use. Discharge is primarily by groundwater pumping, with some groundwater outflow to the Avra Valley and some phreatophyte consumptive use.

TDS concentrations are generally less than 500 ppm along the margins of the valley, and increase toward the center of the valley and the Santa Cruz River. The water beneath the Santa Cruz River generally has a TDS concentration of 500 to 1,000 ppm, and there are pockets of groundwater with TDS concentrations ranging from 1,000 to 3,000 ppm.

Subsidence has historically occurred in the Tucson area. Also, the USGS identified the potential for further future subsidence in the Tucson area, in the vicinity of Tucson and south of Tucson.

III.B.3.d. SC Apache Tribe

Evaluation of groundwater for the SC Apache Tribe focused on the basin fill and stream alluvium associated with the San Carlos and Gila Rivers, and nearby washes. The upper few hundred feet of the basin fill consist of fine sand, silt, limestone, and clay, with interbedded volcanic tuff deposits. The total thickness of basin fill on SC Apache Tribe may be more than 3,200 feet. The stream alluvium, which overlies the basin fill, consists of poorly sorted sandy gravel and gravely muddy sand that occur as channel deposits associated with the rivers. These deposits are up to about 8,000 feet wide and up to about 85 feet thick.

Groundwater likely occurs under unconfined conditions in the alluvial fill. Groundwater in the basin fill tends to occur under unconfined conditions at the margins of the valleys, and the groundwater tends to become confined toward the centers of the valleys.

The likely pattern of groundwater flow is from the mountain fronts toward the Salt and Gila Rivers, and flow parallel to the San Carlos and Gila Rivers beneath the channels. This flow pattern is probably not impacted significantly by the limited amount of groundwater pumping under current conditions.

TDS concentrations of groundwater in the stream alluvium and upper portions of the basin fill beneath the San Carlos River is generally less than 500 ppm of TDS. Groundwater in the stream alluvium beneath the Gila River is generally greater than 500 ppm of TDS, and exceeds 4,000 ppm of TDS in some wells adjacent to the Gila River. In the basin fill near the Gila River, the TDS concentration of groundwater two miles or more from the Gila River is less than 500 ppm, while closer to the Gila River there are pockets with TDS concentrations of more than 2,500 ppm.

III.B.3.e. Navajo-Hopi Reservations

Groundwater beneath the Navajo Nation and Hopi Reservation occurs in sandstone layers located between relatively impermeable siltstone and mudstone layers. Evaluation of groundwater for the Navajo Nation and Hopi Reservation focused on the Navajo/Lukachukai aquifer (N-Aquifer), which is a primary source of groundwater in the Black Mesa area. Groundwater occurs under both confined and unconfined conditions in the N-Aquifer, with unconfined conditions generally occurring in the western, northern, and eastern edges of the aquifer in the Black Mesa area.

Groundwater flow has generally been from the northern area (in the vicinity of Shonto) to the south, from there to the east (toward Chinle wash) and west (toward Tuba City). The flow pattern has been modified due to pumping, such as for the Black Mesa Coal Mine.

TDS concentrations of groundwater in the N-Aquifer range from about 100 to 700 ppm.

III.B.3.f. Tonopah Irrigation District (TID)

This area includes basin fill materials in the “Tonopah Desert” portion of the Hassayampa sub-basin of the Phoenix AMA, south of the Belmont and Big Horn Mountains, and north of the Gila Bend Mountains. The basin fill includes the same three general units discussed in the earlier section for Pinal and Salt River Valley areas. However, the Upper Alluvial Unit is generally de-watered in the Tonopah Desert area, so that the Middle Fine-Grained Unit and the Lower Conglomerate Unit generally comprise the aquifer in the basin fill for this area. Groundwater also occurs in volcanic bedrock underlying the Tonopah Desert. The total thickness of the basin fill and water-bearing volcanic bedrock is more than 1,200 feet thick in the central part of the Tonopah Desert. Groundwater in the TID area occurs under unconfined conditions.

The current pattern of groundwater flow reflects the impact of historical pumping for irrigation. There is a groundwater depression generally located beneath TID. This depression results in inflows from adjacent areas. Components of the hydrologic inventory include groundwater inflow and incidental recharge from irrigation applications. The primary component of groundwater discharge is groundwater pumping.

Limited data were available on water quality and subsidence in the vicinity of TID. Available published data indicate that the TDS concentration in the TID area probably ranges from about 500 to 1,000 ppm. Documentation of historical subsidence for the TID area was not located in published reports. However, groundwater in TID occurs in deposits which are similar to those in the Salt River Valley, where there has been substantial subsidence.

III.B.3.g. Carefree Basin

The Carefree sub-basin is underlain by partially consolidated to consolidated sedimentary rocks, which are as much as about 2,000 feet thick. The primary aquifer consists of alluvial fan and playa deposits. These deposits are underlain by volcanic rocks (which do not yield significant water to wells) and weathered granite (in which well yields of as much as 600 gallons per minute [gpm] have been achieved).

Groundwater flows toward a depression that has developed in the vicinity of the Town of Cave Creek. Present groundwater levels reflect lowering of groundwater levels over time in response to changes in groundwater use due to development. Recharge to the aquifer includes mountain front recharge and percolation from ephemeral washes and the Cave Creek. Discharge is primarily from groundwater pumping and groundwater outflow to the south.

Groundwater in the Carefree sub-basin is generally suitable for most uses, including domestic use. Based on 1977 data, TDS concentrations typically range from about 200 to 700 ppm.

Documentation of historical subsidence for the Carefree sub-basin was not located in published reports. The occurrence of groundwater in the Carefree sub-basin in semi-consolidated to consolidated sediment does indicate that geologic conditions may not be conducive to subsidence.

III.B.3.h. Chaparral Area

The Chaparral City Water Company obtains groundwater from the Fountain Hills sub-basin of the Phoenix AMA. Groundwater occurs primarily within unconsolidated alluvium associated with the Verde River and in the deeper basin fill materials. The unconsolidated alluvium, which consists of gravel, sand, and sandy silt, is generally about one mile wide along the Verde River and more than 90 feet thick. The thickness of the basin fill varies, with the depth to bedrock exceeding 1,200 feet in the center of the valley. The basin fill deposits include fanglomerate at basin margins and grade into interbedded fine sand, silt and clay toward the center of the basin. Near the center of the basin, the materials are predominantly clays, silts, and evaporites.
Groundwater is probably unconfined in the unconsolidated alluvium. There may be some confinement in the basin fill, particularly toward the center of the basin where the materials tend to be finer grained.

Groundwater generally flows from north to south (paralleling the flow in the Verde River) in the Fountain Hills sub-basin, and there is likely also lateral flow from the margins of the valley to the center of the valley. In the vicinity of Chaparral, flow is generally southwesterly, including a component of flow from the Verde River toward the Chaparral area.

Groundwater levels in the Fountain Hills sub-basin have not been highly impacted by groundwater development to date. For the Chaparral area, recharge includes incidental recharge and groundwater inflow from the east. Discharge is primarily from groundwater pumping.

Groundwater in the Fountain Hills sub-basin is generally suitable for most uses, including domestic. Based on data from the early 1980s, TDS concentrations typically range from about 300 to 850 ppm.

Documentation of historical subsidence for the Fountain Hills sub-basin was not located in published reports. Given the reported minimal changes in groundwater levels, subsidence has probably not occurred historically. However, the similarity of the deposits to those in the neighboring East Salt River Valley and the presence of fine-grained materials, indicate that subsidence impacts could occur in the Chaparral area.

III.B.4. Environmental Consequences

This section presents a discussion of the impacts that are anticipated to occur under each of the action alternatives as compared to the conditions anticipated to occur under the No Action Alternative. Impacts addressed include changes to groundwater levels, and potential water quality and subsidence impacts that would be associated with those groundwater level changes.

The discussion of impacts is organized by geographic area. Within the discussion of each geographic area, conditions expected to occur under the No Action Alternative are described first followed by discussion of impact resulting from the action alternatives (including the Settlement Alternative and Non-Settlement Alternatives 1, 2, 3A, and 3B). Most impacts are similar for each action alternative, so that the action alternatives are discussed together. Where there are significant differences among impacts associated with the action alternatives, they have been highlighted in the discussion.

The No Action Alternative reflects the continuation of current water supplies and operations into the future. Evaluation of the No Action Alternative focuses on the changes from 2001 to 2051. Evaluation of the action alternatives focuses on impacts computed as the incremental change in groundwater levels expected to occur under the action alternatives to groundwater levels expected to occur under the No Action Alternative. The estimated incremental changes are considered more reliable than the estimated “absolute” groundwater elevation for each alternative, as the effects of various assumptions with respect to future hydrology (except with regard to proposed CAP allocations) tend to cancel out in this comparison. Anticipated groundwater level impacts that are less than +/- 25 feet were not considered to be of any particular relevance, recognizing the 50-year length of the analysis period and the uncertainties involved in projecting conditions over that period of time. Therefore, discussion in this section concentrates on changes in groundwater level impacts greater than 25 feet over the groundwater levels expected to occur under the No Action Alternative.

A discussion of the relationship between the background assumptions and the groundwater level analysis is provided in Appendix I.

III.B.4.a. Pinal County Area

III.B.4.a.(1) No Action Alternative

Under the No Action Alternative, groundwater levels would decline throughout the Pinal Area from 2001 to 2051, with declines ranging from about 27 to 77 feet. The declines result from continued reliance on groundwater to meet irrigation requirements, and reductions in the availability of CAP water to NIA entities over the long-term. The groundwater level declines in some areas would be moderated by reductions in the cropped acres and associated decreases in water demands. The lower groundwater levels would result in greater pumping costs under the No Action Alternative than under present conditions. While groundwater levels would continue to decline, the depth to groundwater would remain substantially above the 1,000 foot depth “floor” for irrigation use established in the Pinal AMA.

The changes in groundwater levels would not greatly change the flow pattern, and directions of flow would remain the same in year 2051 as in year 2001. Therefore, changes to groundwater quality would not be anticipated to result from changes in the groundwater flow pattern. However, the lowering of groundwater levels in the HIDD, San Carlos Irrigation and Drainage District (SCIDD) and northern CAIDD areas could cause or increase production from deeper zones having poorer quality water. Also, the lower groundwater levels throughout the Pinal County area could result in continued subsidence.

III.B.4.a.(2) Settlement and Non-Settlement Alternatives

Groundwater level impacts in Pinal County for all alternatives are relatively small, with the greatest impact in year 2051 being an increase of about 29 feet relative to the No Action Alternative in the HIDD/SCIDD area. The estimated groundwater level impacts reflect both changes in supplies, and changes in demands that result from reductions in cropped acres.

Figure III-2 shows estimated groundwater level impacts in various locations in the Pinal County area in year 2051. The groundwater level impacts in Pinal reflect changes in the availability of CAP water from the Ag Pool and from NIA allocations relative to the No Action Alternative. The availability of CAP water from the Recharge Pool has a more limited influence on the impacts, because in-lieu recharge water is only available to entities in Pinal County through year 2017.

The only area where the change as compared to the No Action Alternative groundwater level impact would exceed 25 feet is in the HIDD/SCIDD area under the Settlement Alternative. That positive impact (i.e., groundwater levels are higher in 2051 than under the No Action Alternative) results from the availability of Ag Pool water to SCIDD under the Settlement Alternative. The Settlement Alternative is the only alternative in which SCIDD would have access to any sizeable amount of CAP water.

For other areas, the groundwater level impacts generally reflect the change in availability of the total Ag Pool and NIA allocations over the 50-year period. This is illustrated in Figure III-2, which shows both the groundwater level impacts and the availability of CAP water for each alternative. The one exception to this correlation is the impacts for the Settlement Alternative, in which the impacts for some locations are not as favorable as would be expected with the relatively large Ag Pool. This reflects the difference between the distribution of Ag Pool water under the Settlement Alternative and the distribution for the other alternatives; districts in Pinal County would typically receive a smaller proportion of the total Ag Pool under the Settlement Alternative.

The pattern of groundwater flow in year 2051 for the Settlement and Non-Settlement Alternatives would remain similar to the No Action Alternative. Therefore, groundwater quality impacts are not anticipated to result from changes in flow patterns. The Settlement Alternative does result in a relatively large rise (29 feet) in groundwater levels in the vicinity of HIDD and SCIDD relative to the No Action Alternative, which could reduce any influence of poorer quality water at depth in these areas on groundwater produced from wells. That rise in HIDD and SCIDD would also tend to reduce potential subsidence impacts in that area.

III.B.4.b. Gila River Indian Community

III.B.4.b.(1) No Action Alternative

Groundwater levels would generally decline in GRIC from 2001 to 2051 under the No Action Alternative. Groundwater levels would remain essentially unchanged from present levels in the western part of GRIC (i.e., in the vicinity of Komatke and Maricopa Village), while declines of as much as about 48 feet would occur in the eastern and central part of GRIC. The anticipated changes in groundwater levels under the No Action Alternative result from additional supplies available to GRIC relative to historical conditions, the development of additional lands for irrigated agriculture, and changes in groundwater flows between GRIC and adjacent areas. Absent consideration of groundwater underflows to adjacent areas, there would be net recharge to GRIC. Therefore, the declining levels can be attributed to groundwater outflow that would exceed the net recharge.

Changes in groundwater levels would not greatly change the groundwater flow pattern, which would remain essentially the same throughout the study period. There would be groundwater outflow from GRIC to essentially all the adjacent areas; however, groundwater quality would not be anticipated to change as a result of any groundwater level or flow changes. There would be some potential for subsidence due to lowering of groundwater levels in the eastern part of GRIC.

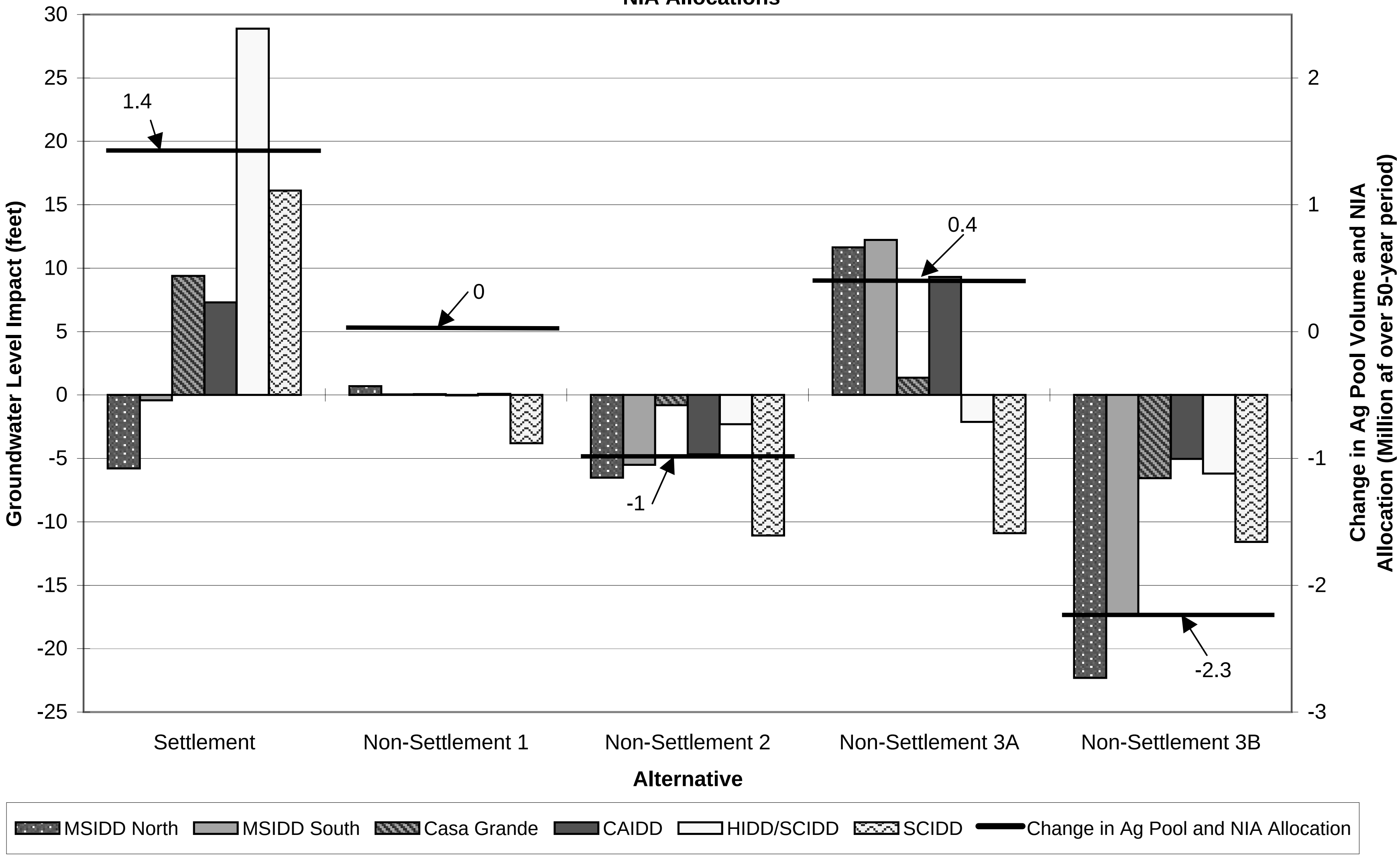
III.B.4.b.(2) Settlement and Non-Settlement Alternatives

Changes in groundwater levels in year 2051 relative to the No Action Alternative are generally small for all alternatives. The largest impact occurs under the Settlement Alternative, in which groundwater levels would be as much as about 26 feet deeper than the No Action Alternative in some locations. The groundwater level impacts in GRIC reflect a number of factors that vary under each alternative, including the amount of CAP water allocated to GRIC and the priority of that water, the total acres developed for irrigation, the build-out schedule, the amount of groundwater pumping, and changes in underflows between GRIC and adjacent areas.

Estimated groundwater level impacts in year 2051 for each alternative are shown in Figure III-3 for areas of GRIC that show the largest estimated impacts. Also shown is the estimated net pumping for each alternative (i.e., the incidental recharge less the groundwater pumping). The net pumping integrates many of the factors which vary among alternatives, except for changes in groundwater underflows between GRIC and adjacent areas. Figure III-3 illustrates that the magnitude of the changes in groundwater levels relative to the No Action Alternative generally relates to the net pumping for the Settlement and Non-Settlement Alternatives. Changes in groundwater underflows also influence these impacts. The occurrence of lower groundwater levels under GRIC relative to the No Action Alternative for the Non-Settlement Alternatives 3A and 3B (in which incidental recharge exceeds pumping) reflects that groundwater outflow from GRIC to adjacent areas increases from the No Action Alternative.

Unlike most of the areas evaluated in this analysis, the water demands on GRIC vary among the alternatives, as does the portfolio of water supplies used to meet those demands. This can result in groundwater level impacts that are at first glance counter-intuitive. For example, while surface water supplies available to GRIC are greatest under the Settlement Alternative, groundwater levels on GRIC generally drop under this alternative, and the lowest groundwater levels for most

FIGURE III-2
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in Year 2051 for Pinal Subareas to Changes in Ag Pool Volume and NIA Allocations



locations generally occur under the Settlement Alternative. The lower groundwater levels primarily reflect that the Settlement Alternative has the greatest cropped acreage (and so the greatest irrigation demand), and the greatest groundwater pumping of any alternative. Groundwater levels on GRIC for all alternatives also reflect that: (1) there is a net groundwater outflow under all alternatives; and (2) improvements in the distribution facilities tend to reduce the incidental recharge under all alternatives.

The pattern of groundwater flow under all of the action alternatives would be similar to the pattern under the No Action Alternative. Therefore, groundwater quality impacts are not anticipated due to changes in groundwater levels or flow patterns. The lower groundwater levels (relative to the No Action Alternative) under the Settlement Alternative and Non-Settlement Alternatives 3A and 3B would have the potential for greater subsidence than under the No Action Alternative. This would particularly apply to the Settlement Alternative, which has the largest groundwater level impacts relative to the No Action Alternative.

III.B.4.c. East Salt River Valley

III.B.4.c.(1) No Action Alternative

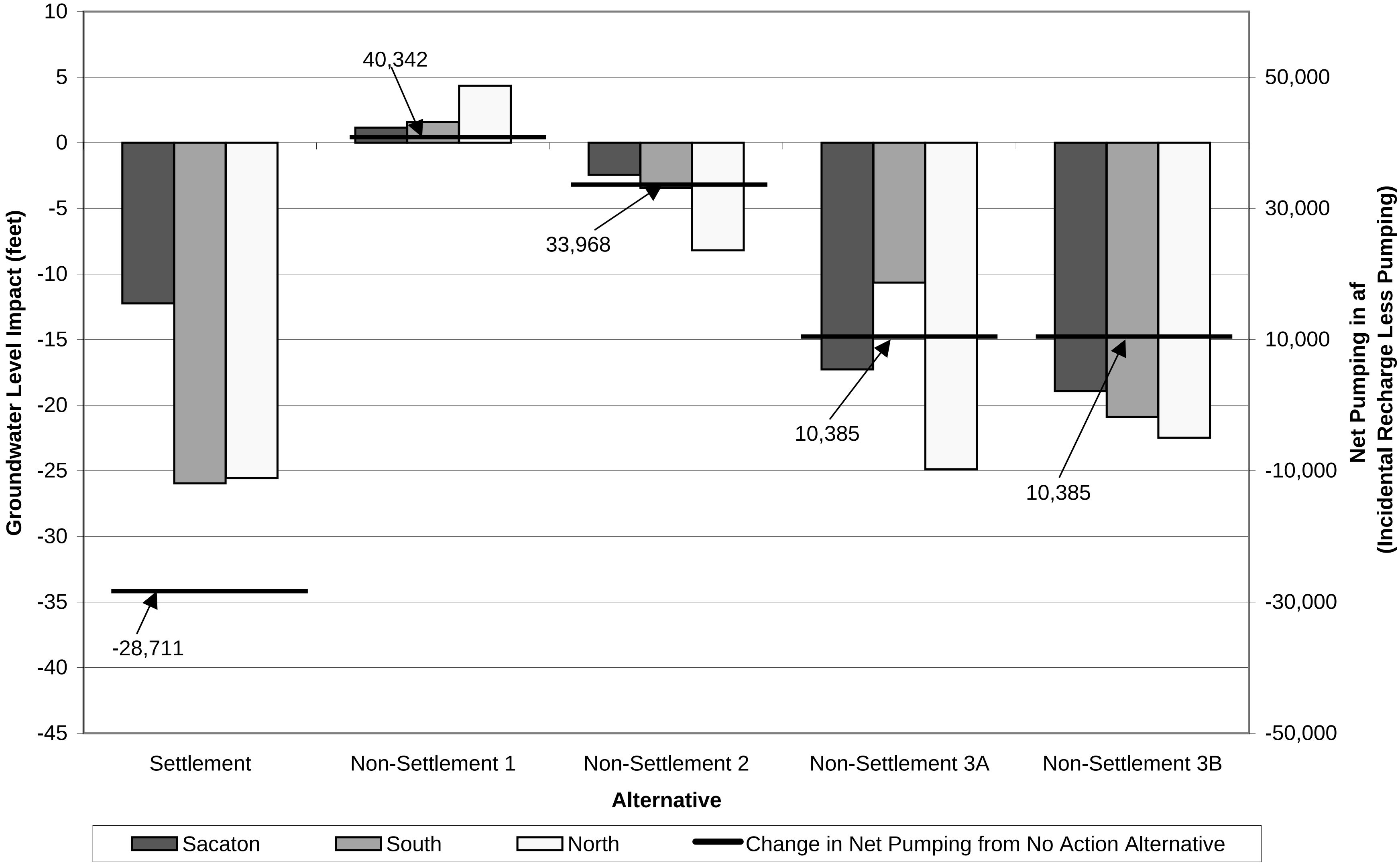
Changes in groundwater elevations from 2001 to 2051 in the East Salt River Valley would vary widely, including increases in groundwater levels in some areas and declines in others. One of the dominant factors influencing groundwater levels is recharge in GRUSP, located near the Salt River where it enters the East Salt River Valley. Groundwater levels would rise in the vicinity of GRUSP (estimated to be as much as about 128 feet). The influence of that recharge also extends beyond the GRUSP facility, resulting in rises in groundwater levels in some locations, and attenuation of declines in other areas. A hydrograph showing estimated groundwater levels occurring in the vicinity of GRUSP under the No Action Alternative (as well as for the action alternatives) is provided on Figure III-4. Groundwater levels rise through the year 2043, when it is assumed that a shortage condition would occur on the Colorado River. As shown, groundwater levels drop relatively rapidly during that shortage period.

The area between the Salt River and GRIC shows substantial declines in groundwater levels during the 2001 to 2051 period, as does the most northerly portion of the East Salt River Valley, and the Apache Junction area. These declines reflect continued reliance on groundwater to meet demands in these areas.

The agricultural lands located in the southeasterly portion of the East Salt River Valley (which include NMIDD, QCID, STID, and CHCID) experience relatively stable or rising groundwater levels over the 2001 to 2051 period under the No Action Alternative. These groundwater level changes reflect the interplay of a number of factors, including continued availability of CAP water from the Ag Pool and Recharge Pool (particularly during the early years), and changes in demands related to urbanization of these lands and reductions in cropped acres due to economic considerations.

There would be some changes in the groundwater flow pattern in the East Salt River Valley by year 2051. Rises in groundwater levels in the vicinity of QCID and the southern part of Scottsdale would eliminate the existing groundwater level depressions in these areas, while a new groundwater level depression would develop near the boundary with GRIC. Also, the recharge at GRUSP would result in radial flow away from that facility by year 2051. The changes in the groundwater flow pattern result in groundwater depressions adjacent to GRIC (where groundwater has relatively high

FIGURE III-3
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in Year 2051 for Selected Subareas in GRIC to Net Pumping on GRIC



concentrations of TDS) rather than in the vicinity of QCID and the southern part of Scottsdale (where groundwater has relatively low concentrations of TDS). This change in flow pattern would tend to reduce the movement of groundwater from areas of high TDS to areas of low TDS. Recharge of CAP water in GRUSP facilities would not be anticipated to result in groundwater quality impacts, as the TDS concentration of the CAP water is similar to the TDS concentration of the underlying groundwater.

Groundwater levels would continue to decline in a number of areas in the East Salt River Valley under the No Action Alternative, and subsidence could occur in these areas. This includes the northern Scottsdale and Phoenix areas, lands lying between the Salt River and GRIC, and the Apache Junction area.

III.B.4.c.(2) Settlement and Non-Settlement Alternatives

Groundwater level impacts of the Settlement and Non-Settlement Alternatives in the East Salt River Valley (relative to the No Action Alternative) reflect different influences for different locations in the analysis area. The largest influences on these impacts appear to be the amount of direct recharge that would occur at GRUSP, and factors affecting NIA entities.

Changes in year 2051 groundwater levels for each action alternative relative to the No Action Alternative for areas strongly influenced by direct recharge at GRUSP are shown on Figure III-5. Also shown is the change in the CAP water available from the Recharge Pool for each action alternative relative to the No Action Alternative. The decline in groundwater levels for each non-settlement alternative generally reflects the reduction in the CAP Recharge Pool for that alternative. The magnitude of these declines is also greatest close to GRUSP (i.e., on the Salt River Indian Reservation and the western part of Mesa); smaller impacts tend to occur with increasing distance from GRUSP.

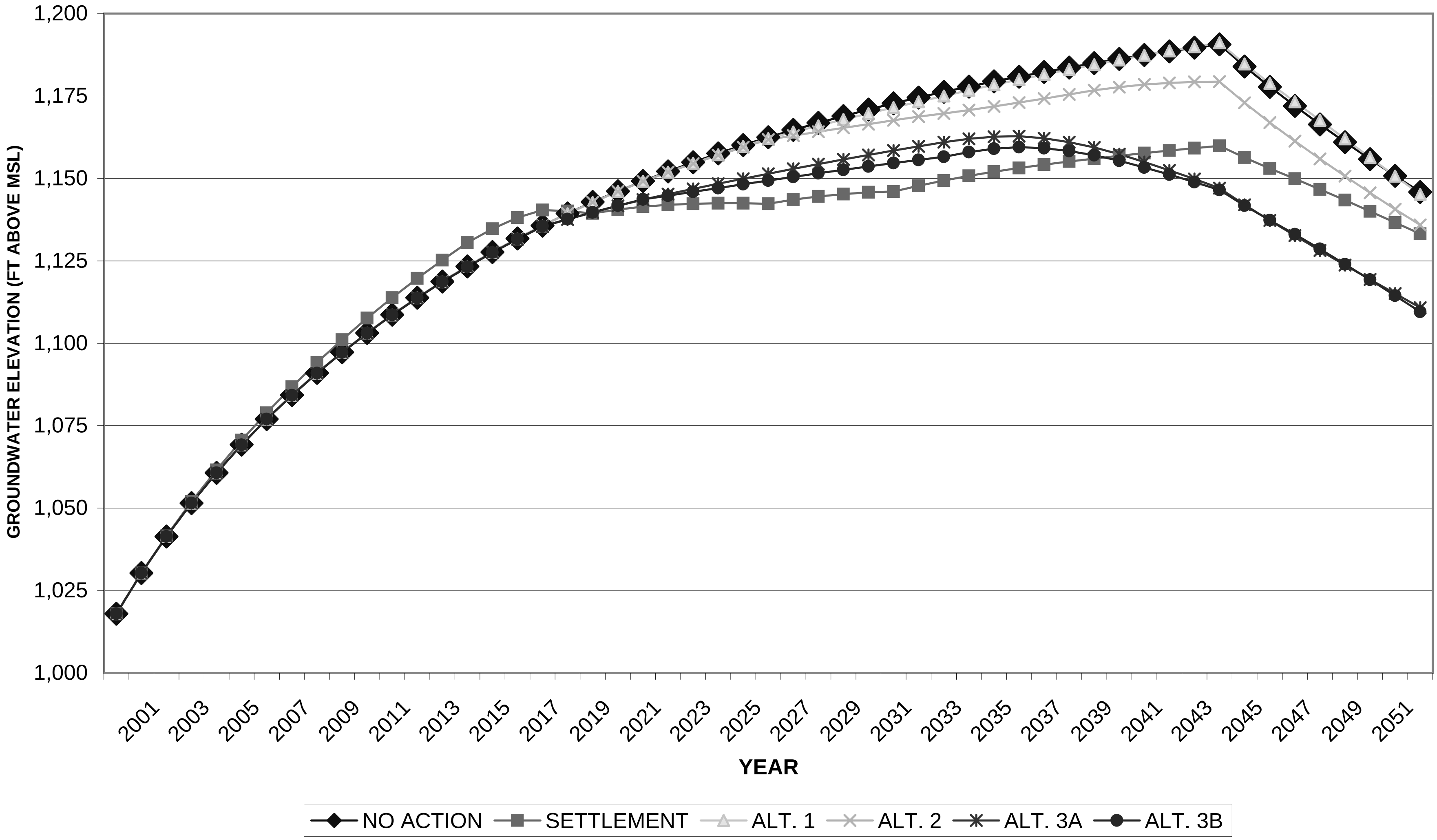
The groundwater levels for the Settlement Alternative are not as closely related to the reduction in the recharge pool. While the Settlement Alternative has the greatest reduction in the recharge pool, relatively small groundwater level impacts reflect that the cities of Mesa and Chandler would receive additional CAP water from GRIC in exchange for effluent that would otherwise be unused. Without that additional CAP supply, the largest negative groundwater level impacts would have been expected for the Settlement Alternative.

The differences in the groundwater level impacts over time can be seen on the groundwater level hydrograph shown on Figure III-5. The variations result from differences in the availability of groundwater to the Recharge Pool among the alternatives.

Relatively large groundwater level impacts would also occur in the vicinity of the NIA entities (NMIDD, QCID, STID, and CHCID). Changes in groundwater levels in 2051 for the action alternatives relative to the No Action Alternative are shown on Figure III-6 for NMIDD and QCID. Groundwater levels are typically about 65 to 80 feet deeper than under the No Action Alternative, except for Non-Settlement Alternative 1. There would be smaller changes in groundwater levels under that alternative, due to a lesser reduction in the amount of recharge water relative to the No Action Alternative, and earlier reductions in cropped acreage.

In general, the pattern of groundwater flow in 2051 for all action alternatives would be similar to the pattern for the No Action Alternative. However, there could be some differences (particularly

FIGURE III-4
CAP Allocation Draft EIS
Hydrograph of Estimated Groundwater Levels Occurring in the Vicinity of GRUSP - All Alternatives



for the Settlement Alternative and Non-Settlement Alternatives 3A and 3B) in the vicinity of GRUSP reflecting that there would be a less pronounced groundwater "mound" for those alternatives. Also, a groundwater level depression would remain in the vicinity of QCID under the Settlement Alternative. For all of the action alternatives, groundwater quality impacts associated with the small changes in the groundwater flow pattern relative to the No Action Alternative would not be anticipated. Also, direct recharge of CAP water at GRUSP would not be anticipated to result in groundwater quality impacts, as the TDS concentration of the CAP water is similar to the TDS concentration in the underlying groundwater.

Groundwater levels would be generally deeper under the action alternatives than under the No Action Alternative. These deeper levels indicate a greater potential for subsidence than under the No Action Alternative. One exception is that, while groundwater levels in the vicinity of GRUSP would be lower than under the No Action Alternative, they would remain above present levels, so that subsidence may not be anticipated at that location.

III.B.4.d. West Salt River Valley

III.B.4.d.(1) No Action Alternative

Changes in groundwater elevations from 2001 to 2051 in the West Salt River Valley would vary widely, including increases in groundwater levels in some areas and declines in others. Substantial declines are projected for the Phoenix area (as much as about 295 feet) and the west side area near the existing Luke Cone groundwater level depression (as much as about 150 feet). These impacts reflect continued reliance on groundwater to meet much of the demands in these areas.

Direct recharge at the planned Agua Fria facility and proposed future westside recharge facilities has a substantial influence on groundwater levels. A hydrograph showing estimated groundwater levels in the vicinity of the Aqua Fria recharge facility under the No Action Alternative (as well as for the action alternatives) is provided on Figure III-7. Groundwater levels would rise through the year 2043, when it is assumed that a shortage condition on the Colorado River would occur. As shown, groundwater levels would drop relatively rapidly during that shortage period. There would also be direct recharge at proposed future westside facilities on the west side of the valley. Those facilities are not anticipated to come operational until year 2017. While groundwater levels are expected to decline in this area over the 2001 to 2051 period, these declines would be moderated by the direct recharge.

There would be changes in the groundwater flow pattern by year 2051. A groundwater depression would form beneath the northern portion of Phoenix in the West Salt River Valley. The existing Luke Cone groundwater level depression would remain. Under the No Action Alternative, groundwater flow would continue from areas with relatively poor quality water beneath the Gila River to northerly areas that presently have relatively good quality water. Also, lower groundwater levels in the vicinity of the "Luke salt dome" could result in lower quality water being produced from wells in that area. Recharge of CAP water in the Agua Fria and future westside recharge facilities could eventually result in higher TDS concentrations in the underlying groundwater, as the CAP water has a higher TDS concentration than the groundwater.

Subsidence would be anticipated under the No Action Alternative in the eastern and western areas of the West Salt River Valley, where relatively large declines in groundwater levels would occur.

FIGURE III-5
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in Year 2051 for Selected East Salt River Valley Subareas to Reductions in Recharge Pool

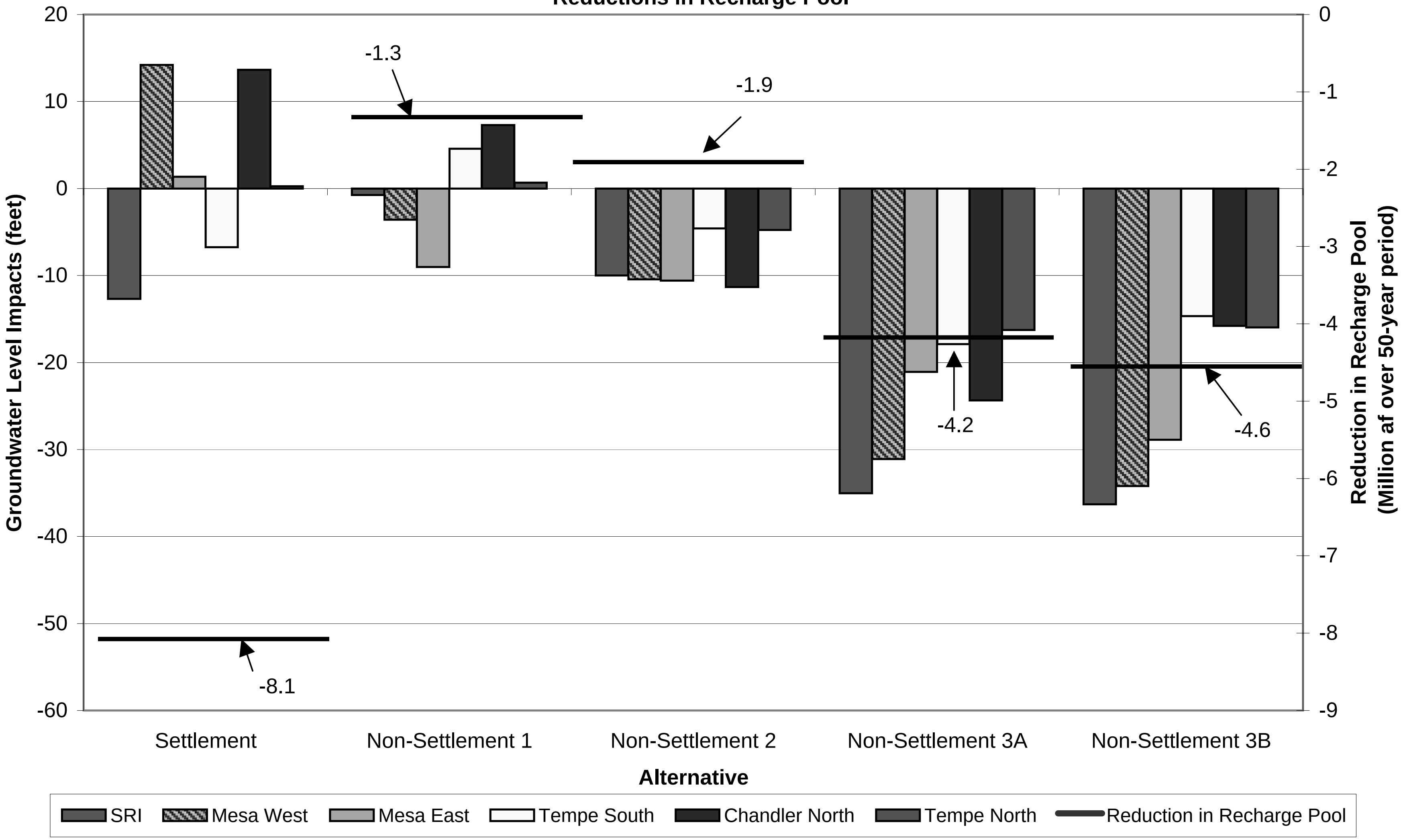
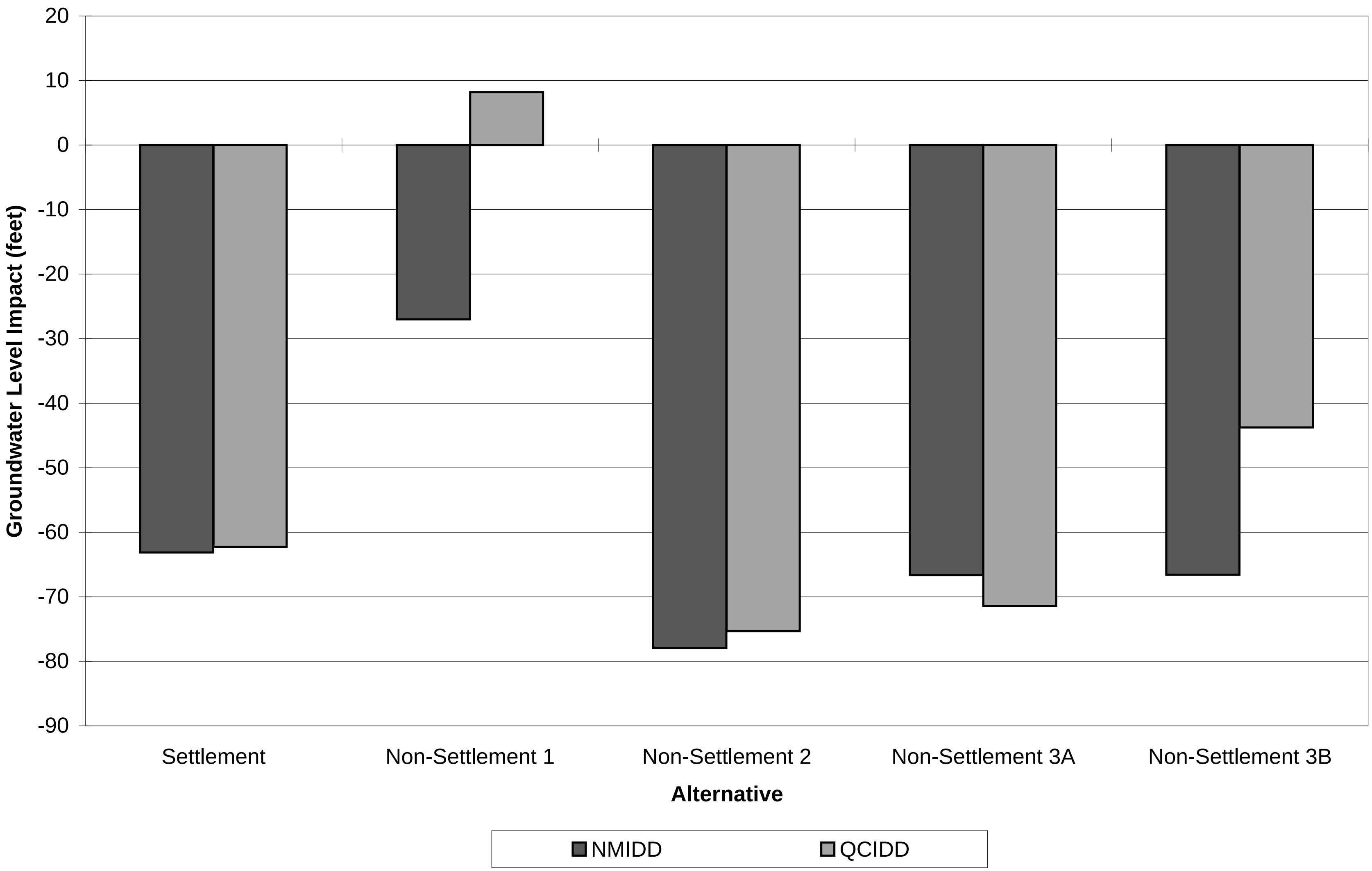


FIGURE III-6
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in Year 2051 for QCIDD and NMIDD Sub-Areas



III.B.4.d.(2) Settlement and Non-Settlement Alternatives

Groundwater level impacts of the Settlement and non-settlement alternatives in year 2051 primarily reflect the influence of direct recharge at the Agua Fria and future westside recharge facilities in the West Salt River Valley. The largest impacts occur near these facilities. Estimated changes in groundwater levels for the action alternatives relative to the No Action Alternative are shown on Figure III-8 for selected areas. As shown on that Figure, CAP water available from the Recharge Pool for all of the action alternatives would be reduced relative to the No Action Alternative. The magnitude of the decline in groundwater levels from No Action groundwater levels for each alternative generally reflects the reduction in CAP water available from the Recharge Pool.

The differences in the groundwater level impacts over time can be seen on the groundwater level hydrograph shown on Figure III-7. The differences among the various alternatives are primarily a result of differences in the availability of CAP water from the Recharge Pool.

In general, the pattern of groundwater flow in 2051 for all action alternatives would be similar to the pattern for the No Action Alternative. For all of the action alternatives, the changes in the groundwater flow pattern relative to the No Action Alternative are relatively small, and groundwater quality impacts associated with these changes are not anticipated. However, the greater declines in groundwater levels relative to the No Action Alternative in the vicinity of the Luke salt dome, particularly for the Settlement Alternative and Non-Settlement Alternatives 3A and 3B, would have the potential to result in greater influence of the poor quality water at depth in groundwater produced by wells. The reduced direct recharge of CAP water could potentially result in lower TDS concentrations in groundwater near the Agua Fria and future westside recharge facilities than would occur under the No Action Alternative, in the later years.

There would be declines in groundwater levels relative to the No Action Alternative in the western part of the West Salt River Valley for all of the action alternatives. These declines would be relatively large under the Settlement Alternative and Alternatives 3A and 3B. These groundwater level declines could result in greater subsidence than would occur under the No Action Alternative.

III.B.4.e. Avra Valley

III.B.4.e.(1) No Action Alternative

Changes in estimated groundwater levels during the 2001 to 2051 period in Avra Valley under the No Action Alternative would vary widely. The largest changes in groundwater levels occur in the southern part of Avra Valley. Groundwater levels would rise more than 300 feet in the vicinity of the Central Avra Valley Storage and Recovery Project (CAVSRP) direct recharge facility, in response to the recharge of CAP M&I allocations in that facility. Groundwater levels would decline more than 150 feet at the City of Tucson wellfield located southerly of CAVSRP. Smaller increases in groundwater levels occur in the vicinity of other direct and in-lieu recharge facilities located along the Santa Cruz River and in the North Avra Valley.

Significant changes in groundwater quality are not expected under the No Action Alternative. However, there would be the potential for subsidence in the southern part of Avra Valley due to the lower groundwater levels.

FIGURE III-7
CAP Allocation Draft EIS
Hydrograph of Estimated Groundwater Levels Occurring in the Vicinity of the Agua Fria Recharge Facility - All Alternatives

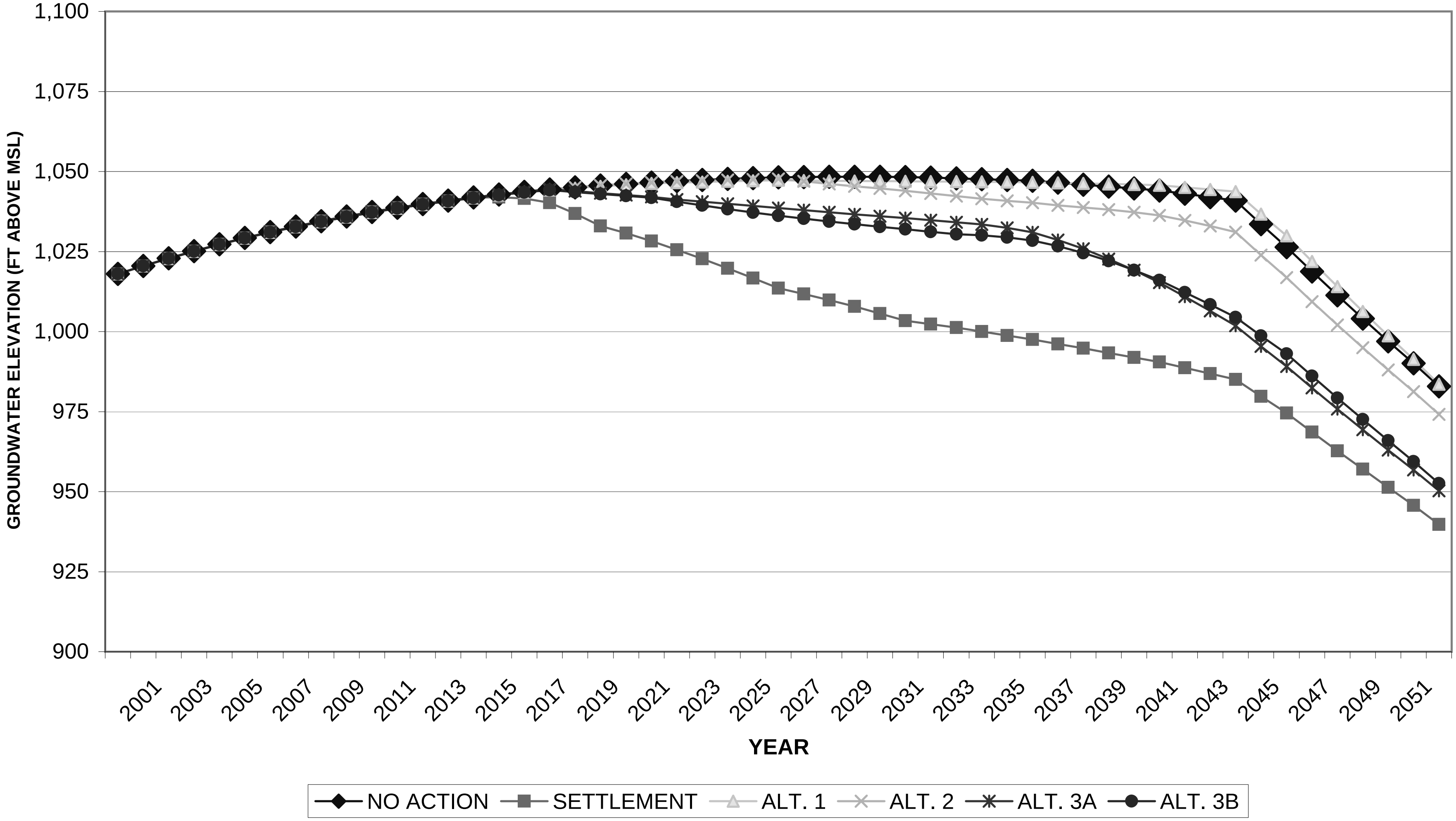
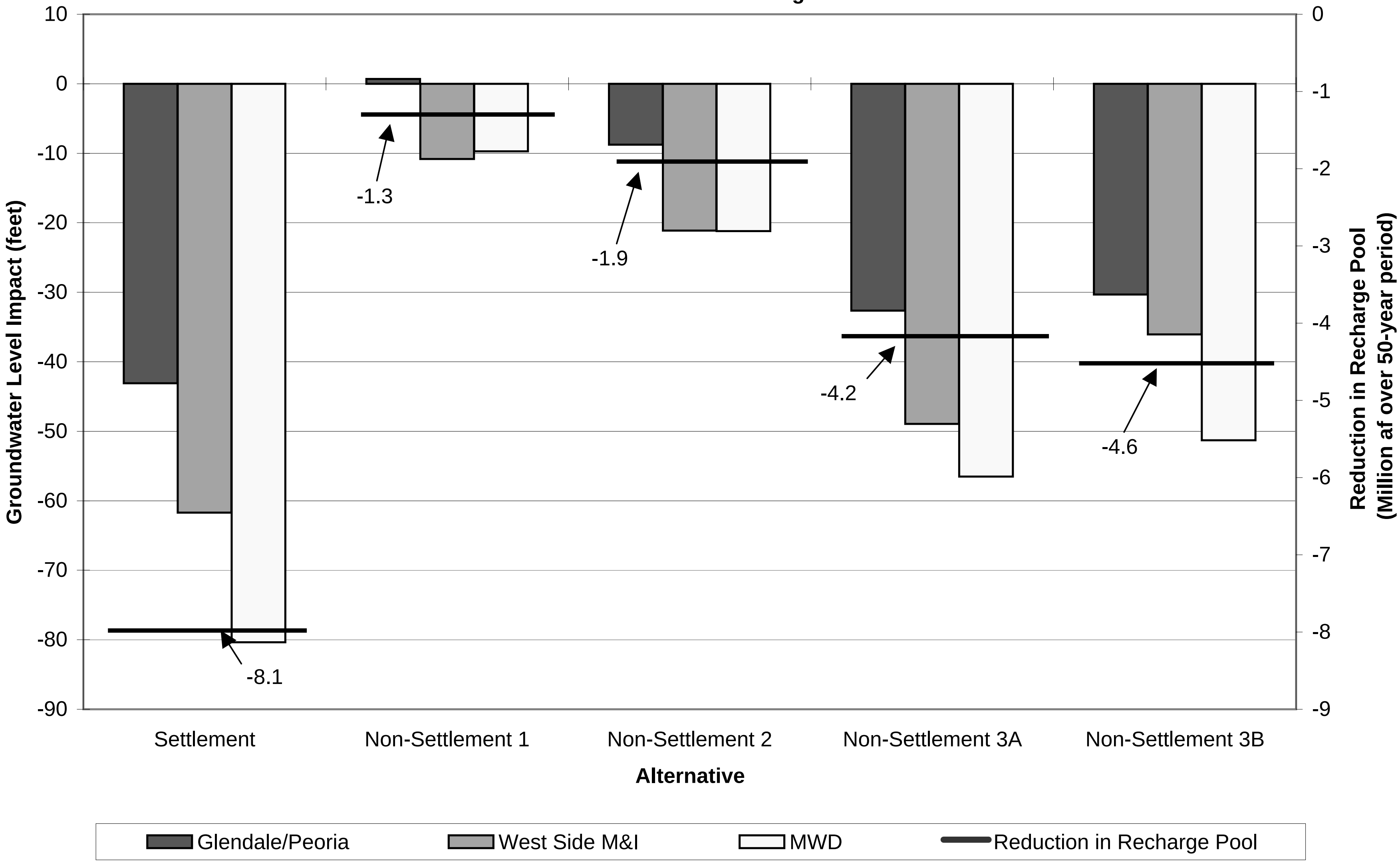


FIGURE III-8
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in Year 2051 for Selected Subareas in the West Salt River Valley to Reductions in CAP Recharge Pool



III.B.4.e.(2) Settlement and Non-Settlement Alternatives

Impacts would be very small throughout Avra Valley. While these impacts are small, they do reflect the changes in water supplies for each alternative. The magnitude of the impacts for the Avra Coop under each alternative reflect changes in CAP water available and changes in recharge amounts in nearby areas. The magnitude of impacts in the South Avra Valley sub-area reflect the Schuk Toak District's receipt of additional CAP water under the Settlement Alternative and Non-Settlement Alternatives 2, 3A, and 3B.

Because the groundwater level impacts would be very small, water quality and subsidence impacts (i.e. changes from No Action) would not be anticipated. Groundwater pumping costs would not differ significantly from the costs under the No Action Alternative.

III.B.4.f. Tucson Area

III.B.4.f.(1) No Action Alternative

Changes in estimated groundwater levels under the No Action Alternative during the 2001 to 2051 period would range from a decline of 111 feet to a rise of 57 feet. Most of the Tucson area would experience groundwater level declines over the 2001 to 2051 period, reflecting continued reliance on groundwater to meet demands and increased demand associated with population growth. Lower groundwater levels would result in higher pumping costs in these areas.

Groundwater levels would rise in the eastern part of the San Xavier District and the Western part of Tucson. These rises reflect the impact to direct recharge of CAP water at most locations. Groundwater pumping costs would be reduced in these areas.

The groundwater flow pattern would generally be similar to the existing flow pattern, except that a groundwater mound would develop beneath the eastern part of the San Xavier District. This mound could result in the movement of poorer quality water beneath the Santa Cruz River to the east. However, the TDS concentration of the recharged CAP water would be lower than the poorer quality groundwater, and would tend to provide an offsetting improvement in groundwater quality. Substantial changes in groundwater quality would not be anticipated under the No Action Alternative under these conditions. The relatively large declines in groundwater levels (over 25 feet by year 2051) both north and south of the metropolitan Tucson area could result in continued subsidence.

III.B.4.f.(2) Settlement and Non-Settlement Alternatives

Groundwater levels throughout the Tucson area would be higher under all of the action alternatives than under the No Action Alternative. However, these impacts are generally relatively small (less than 25 feet). These higher groundwater levels would result in a reduced cost per af of pumping.

The largest impacts are shown for the eastern part of the San Xavier District of the Tohono O'odham Nation under the Settlement Alternative and Non-Settlement Alternatives 2, 3A, and 3B, in which groundwater levels would be about 70 to 80 feet higher than under the No Action Alternative as illustrated on Figure III-9, the higher groundwater levels relative to the No Action Alternative result from additional CAP supplies for the San Xavier District, which would be used for irrigation and direct/indirect recharge. The relatively large groundwater rise beneath the eastern San Xavier District would also cause an increase in groundwater levels in the Green Valley area to the south.

As shown on Figure III-10, under the Settlement Alternative and Non-Settlement Alternatives 1 and 3B, groundwater levels in the eastern portion of the Cortaro-Marana area, MDWID, and the metropolitan Tucson area show increases in groundwater levels of about 20 to 40 feet relative to the No Action Alternative. The additional CAP water that would be available to M&I entities through CAP allocations are also shown on Figure III-10. The groundwater level impacts result from use of these additional supplies and the associated reduction in groundwater pumping.

The groundwater flow pattern for all of the action alternatives would be similar to the No Action Alternative and changes in groundwater quality would be similar to those under the No Action Alternative. One difference is that a ground level depression would develop in the Green Valley area. This could result in an adverse salt balance in that area.

Because groundwater levels are higher than under the No Action Alternative throughout the Tucson area under all of the action alternatives, these alternatives would tend to reduce the potential for continued subsidence.

III.B.4.g. San Carlos Apache Tribe

III.B.4.g.(1) No Action Alternative

Under the No Action Alternative, irrigation would be expanded using the existing CAP allocation for SC Apache Tribe. Use of surface water for irrigation would increase incidental recharge along the San Carlos and Gila Rivers, where the new irrigated lands are anticipated to be located. The result would be a rise in groundwater levels in the alluvium associated with the San Carlos and Gila Rivers, essentially filling presently unfilled storage space. Water quality and subsidence impacts would not be anticipated.

III.B.4.g.(2) Settlement and Non-Settlement Alternatives

For Non-Settlement Alternatives 2 and 3, additional lands would be irrigated along the San Carlos and Gila Rivers. As with the No Action Alternative, this could fill the presently unfilled storage in the alluvium, so that there would be no impact (i.e., the groundwater levels for Non-Settlement Alternatives 2 and 3 would be the same as the No Action Alternative). Subsidence and water quality impacts would not be anticipated.

Impacts under the Settlement Alternative and Non- Settlement Alternative 1 would be the same as for the No Action Alternative.

III.B.4.h. Hopi Tribe and Navajo Nation

A qualitative rather than quantitative analysis was performed to estimate impacts of the alternatives on groundwater on the Navajo Nation and Hopi Tribes, reflecting that:

- The distribution of available CAP water between the Navajo and Hopi Tribes is not known, nor are the specific uses;

Figure III-9
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in San Xavier East and Green Valley Central Sub-Areas to San Xavier District CAP Use

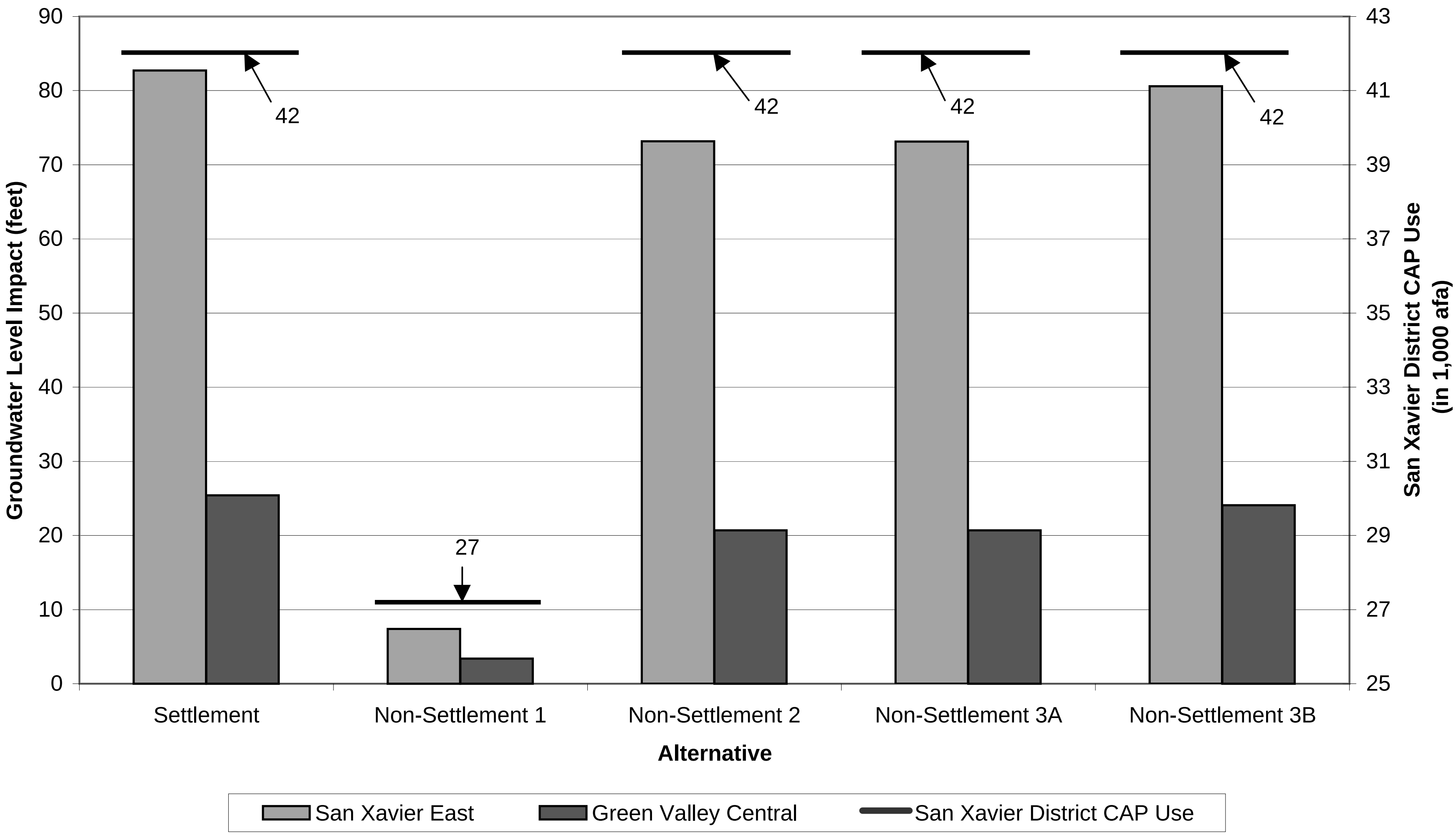
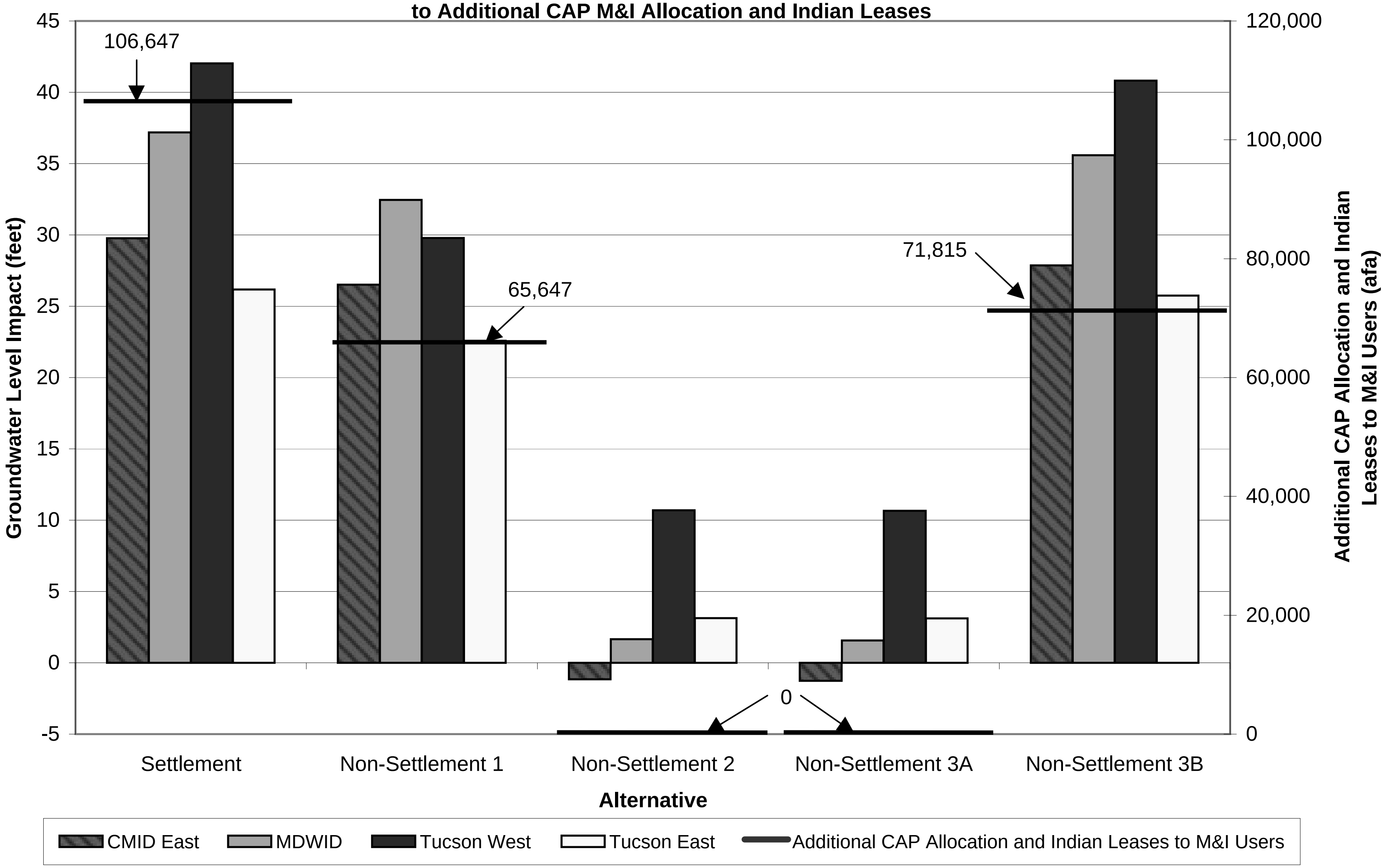


FIGURE III-10
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in Year 2051 for Selected Subareas in the Tucson Area to Additional CAP M&I Allocation and Indian Leases



- Estimates of present and future population and water demands tend to vary widely among various sources; and

- There is not consensus of involved entities on the characteristics of the groundwater system.

For these reasons, the impact analysis is based on evaluation of the incremental change in CAP water supplies among alternatives. Available CAP supplies would be used to offset groundwater pumping, resulting in an incremental increase in groundwater storage.

III.B.4.h.(1) No Action Alternative

CAP water would not be available to the Navajo Nation and Hopi Tribe under the No Action Alternative.

III.B.4.h.(2) Settlement and Non-Settlement Alternatives

CAP water would not be available to the Navajo and Hopi Tribes from the re-allocation process under the Settlement Alternative and Non-Settlement Alternative 1. Therefore, there would not be an incremental change in groundwater storage for these alternatives relative to the No Action Alternative.

For Non-Settlement Alternatives 2, 3A, and 3B, a total of 675,000 acre-feet of CAP water would be available to the Navajo Nation and Hopi Tribe over the 50-year period of analysis. This would result in an incremental increase in groundwater storage of 675,000 acre-feet relative to storage under the No Action Alternative. This represents an increase of about two-tenths to four-tenths of a percent in the volume of groundwater storage in the N-aquifer. The increased groundwater storage would result in higher average groundwater levels in the N-aquifer for these alternatives relative to the No Action Alternative. However, information is not available to evaluate how levels might change in specific locations.

III.B.4.i. Tonopah Irrigation District

III.B.4.i.(1) No Action Alternative

Under the No Action Alternative, groundwater levels would rise by about 45 feet during the early years of the study period (from 2001 to 2017) and then decline through year 2051. From 2001 to 2051, the net groundwater level impact is a decline in groundwater levels of about 17 feet. These impacts occur due to reduced availability of CAP water to TID over time, and increased reliance on groundwater pumping to meet irrigation demands. Groundwater pumping costs would not be significantly different from present costs under this alternative.

Significant changes in the groundwater quality are not expected under the No Action Alternative. Also, the relatively small decline in groundwater levels in year 2051 (17 feet) would not be anticipated to result in significant potential for subsidence.

III.B.4.i.(2) Settlement and Non-Settlement Alternatives

Groundwater levels in the TID area would be lower for all action alternatives than under the No Action Alternative. These negative groundwater level impacts range from about 17 to 41 feet in year 2051, as shown on Figure III-11. The magnitude of the groundwater level impact relates to the change in total excess CAP water available from the Ag Pool, the Recharge Pool, and NIA allocations under each alternative relative to the No Action Alternative, as illustrated on Figure III-11. The greater pumping lifts would result in greater pumping costs than under the No Action Alternative.

As the groundwater level impacts are very small, significant groundwater quality impacts would not be anticipated. Groundwater pumping costs would not differ significantly from the costs under the No Action Alternative.

III.B.4.j. Carefree Sub-Basin

III.B.4.j.(1) No Action Alternative

Under the No Action Alternative, groundwater levels would rise during the early years of the study period due to full use of available CAP supplies. However, groundwater pumping would increase to meet growing demands, resulting in groundwater level declines in the later years.

From 2001 to 2051, the groundwater level would decline by about 13 feet. Groundwater pumping costs would not be significantly different from present costs under this alternative.

Significant changes in the groundwater quality are not expected under the No Action Alternative. Also, the relatively small decline in groundwater levels in year 2051 (13 feet) would not be anticipated to result in significant potential for subsidence in the consolidated sediments underlying the Cave Creek area.

III.B.4.j.(2) Settlement and Non-Settlement Alternatives

Non-Settlement Alternatives 2 and 3A have the same CAP supplies for this sub-basin as the No Action Alternative. Therefore, no impacts to groundwater level, groundwater quality, and subsidence relative to the No Action Alternative are anticipated for these alternatives.

Groundwater levels under the Settlement Alternative and Non-Settlement Alternatives 1 and 3B would be about 58 feet higher than under the No Action Alternative by year 2051. These positive groundwater level impacts reflect the availability of additional CAP water, and the corresponding reduction in groundwater pumping. Groundwater pumping costs under these alternatives would be lower than under the No Action Alternative, reflecting the higher groundwater levels. Significant groundwater quality impacts would not be anticipated.

III.B.4.k. Chaparral/Fountain Hills

III.B.4.k.(1) No Action Alternative

Under the No Action Alternative, groundwater levels would rise during the early years of the study period due to full use of currently available CAP supplies. However, groundwater pumping would increase to meet growing demands, resulting in groundwater level declines in the later years. From 2001 to 2051, the groundwater level would decline by about 50 feet. The groundwater level decline would result in greater costs for groundwater pumping.

Significant changes in the groundwater quality are not expected under the No Action Alternative. However, the 50-foot decline in groundwater levels through the year 2051 indicates potential for subsidence under the No Action Alternative.

III.B.4.k.(2) Settlement and Non-Settlement Alternatives

Non-Settlement Alternatives 2 and 3A have the same CAP supplies for this sub-basin as the No Action Alternative. Therefore, impacts to groundwater level, groundwater quality, and subsidence relative to the No Action Alternative would not be anticipated to occur. Also, groundwater pumping costs would be the same as the No Action Alternative.

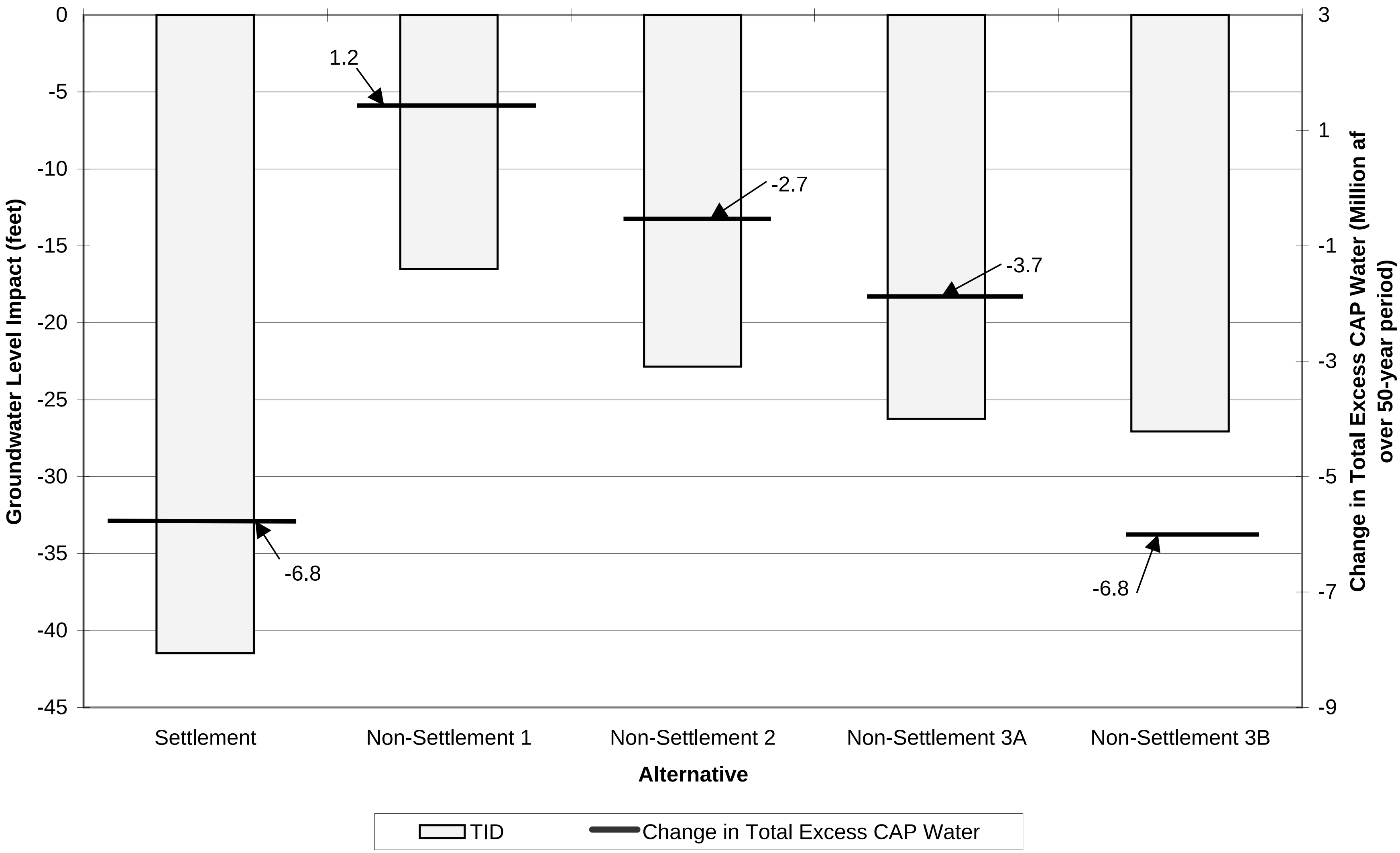
Groundwater levels under the Settlement Alternative and Non-Settlement Alternatives 1 and 3B would be about 20 feet higher than under the No Action Alternative by year 2051. These positive groundwater level impacts reflect the availability of additional CAP water, and the corresponding reduction in groundwater pumping. The higher groundwater levels would result in reduced costs for groundwater pumping.

As the groundwater level impacts are small, significant groundwater quality impacts would not be anticipated. The positive groundwater level impacts would tend to reduce subsidence impacts in the Chaparral area relative to the No Action Alternative.

III.B.4.l. Effluent

The level of effluent discharge from existing wastewater treatment plants is projected to continue at current or increased levels under the No Action and all action alternatives. As population increases, it is anticipated that effluent would not be sent to the regional wastewater treatment plants, such as Phoenix's 91st Avenue Wastewater Treatment Plant, but rather would be treated locally in smaller wastewater treatment plants, such as the one at the Anthem development north of Phoenix. These local wastewater treatment plants may use the reclaimed water for turf facilities, groundwater recharge, or discharge to streams. For the alternatives under which the M&I entities do not receive an additional CAP allocation (i.e., the No Action Alternative and Non-Settlement Alternatives 2 and 3A), it is estimated that more reclaimed water would be used for turf facilities than for the other alternatives (see tables of Summary of Projected Water Uses for Each Entity in Appendix C for estimated differences in effluent reuse by alternative).

FIGURE III-11
CAP Allocation Draft EIS
Comparison of Groundwater Level Impacts in Year 2051 in TID to Change in Total Excess CAP Water



III.B.4.m. Colorado River Mainstem

Under the No Action, Settlement, and Non-Settlement Alternative 1, no change in the diversion pattern off of the Colorado River would occur from the current practice of full CAP diversion at Parker Dam. Therefore, no impacts to the Colorado River mainstem would occur.

Under Non-Settlement Alternatives 2 and 3, 13,500 afa for the Navajo Nation and Hopi Tribe would likely be diverted from Lake Powell. This diversion is estimated to lower the Colorado River water surface between Lake Powell and Lake Mead less than 0.02 inch and the impacts are considered *de minimis.*

III.B.5. Summary of Water Resources Impacts

Groundwater level impacts for entities considered in this analysis are summarized in Table III-1. The values shown for the Settlement and Non-Settlement Alternatives are the differences in estimated groundwater levels in year 2051 for each alternative relative to the No Action Alternative.

The groundwater level impacts for many of the entities are less than 25 feet, and are not considered to be of any particular relevance, recognizing the 50-year length of the analysis period, and the uncertainties involved in projecting conditions over that period of time. Even the groundwater level impacts which exceed 25 feet (which are shaded in Table III-1) are of limited importance. In no sub-area under any alternative is the magnitude of groundwater level decline by year 2051 large enough to substantially limit the ability of any entity to physically recover groundwater. The relatively small groundwater level impacts also indicate that none of the alternatives would substantially impact the ability to achieve safe yield in the AMAs. The increased costs associated with pumping at greater depths are generally small in relation to the costs of developing alternative water supplies for M&I use.

Potential subsidence impacts would generally reflect the groundwater level impacts summarized in Table III-1. Positive groundwater level impacts (i.e., groundwater levels higher than under the No Action Alternative) would result in reduced potential for subsidence, while negative groundwater level impacts (groundwater levels lower than under the No Action Alternative) would result in increased potential for subsidence.

A significant factor in the relatively small groundwater level impacts experienced under all alternatives is the availability of substantial amounts of excess water during the early years of the analysis. This excess water availability means that many entities which do not get CAP allocations would have continued access to CAP through the Ag Pool or Recharge Pool. Larger groundwater level impacts would be anticipated if either the contracted CAP water were fully used (thus reducing the amount of excess water available), or if different assumptions were made as to the distribution of the excess water.

Table III-1
CAP Allocation Draft EIS
Groundwater Impacts[1] in Year 2051 for All Entities
(in units of feet unless otherwise noted)

ENTITIES	SETTLEMENT ALTERNATIVE	NON-SETTLEMENT ALTERNATIVE 1	NON-SETTLEMENT ALTERNATIVE 2	NON-SETTLEMENT ALTERNATIVE 3A	NON-SETTLEMENT ALTERNATIVE 3B
M&I ENTITIES					
Arizona Water Company – Apache Junction	3	4	-5	-8	-4
AVRA Water Cooperative	-6	-3	-5	-5	-6
Cave Creek Water Company	**58**	**58**	0	0	**58**
City of Chandler	**14 to 38**	7 to 18	-11 to -14	-24	-4 to –16
Chaparral City Water Company	20	20	0	0	20
Community Water Company of Green Valley	**25**	3	21	21	24
City of El Mirage	**-62**	-11	-21	**-49**	**-36**
City of Glendale	**-43 to -80**	1 to -11	-9 to -21	**-33 to -57**	**-30 to -51**
City of Goodyear	-1 to –81	5 to -11	-3 to -21	**-4 to -57**	**0 to –51**
H20 Water Company	**-62**	8	**-75**	**-71**	**-44**
City of Mesa	-8 to 14	-9 to 13	**-10 to -33**	**-21 to -38**	**-19 to –34**
Metropolitan Domestic Water Improvement District	**30 to 37**	**27 to 32**	-1 to 2	-1 to 2	**28 to 36**
Town of Oro Valley	**14 to 30**	**12 to 27**	0 to -1	0 to -1	**13 to 28**
City of Peoria	**-4 to -43**	1 to 11	-5 to -9	-13 to -14	**2 to –30**
City of Phoenix	**6 to -43**	2 to -11	0 to -9	**-1 to -33**	**0 to -30**
City of Scottsdale	6 to -21	2 to -18	0 to -8	**-1 to -28**	**0 to -48**
Town of Superior/Arizona Water Company-Superior	**-44**	-12	**-47**	**-41**	**-39**
City of Surprise	**-4 to -80**	-10 to 11	-5 to -21	**-14 to -57**	**2 to -51**
City of Tucson	**4 to 42**	**0 to 30**	3 to 11	3 to 11	**3 to 41**
Vail Water Company	13	4	8	8	12
Valley Utilities Water Company	**-62**	-11	-21	**-49**	**-36**
NIA ENTITIES					
Central Arizona Irrigation and Drainage District	7	0	-5	9	-5
Chandler Heights Citrus Irrigation District	**-62**	8	**-75**	**-71**	**-44**
Maricopa-Stanfield Irrigation & Drainage District	0 to –6	0 to 1	-6 to –7	12	-17 to –22
New Magma Irrigation and Drainage District	**-63**	**-27**	**-78**	**-67**	**-67**
Queen Creek Irrigation District	**-62**	8	**-75**	**-71**	**-44**
Roosevelt Irrigation District	0 to –6	0 to 5	0 to –3	0 to –9	0 to –3
San Carlos Irrigation and Drainage District	**9 to 29**	0 to –4	-1 to –11	-1 to 12	-12 to –6
San Tan Irrigation District	**-62**	8	**-75**	**-71**	**-44**
Tonopah Irrigation District	**-41**	-17	-23	**-26**	**-27**
INDIAN ENTITIES					
Gila River Indian Community	**-26 to –8**	-2 to 4	-8 to -2	-25 to -3	-22 to -4
Hopi Tribe and Navajo Nation (change in groundwater storage in af)	0	0	**675,000**	**675,000**	**675,000**
San Carlos Apache Tribe	0	0	0	0	0
Tohono O'odham Nation	**4 to 83**	0 to 7	**3 to 73**	**3 to 73**	**3 to 81**

(1) Impacts are computed as No Action groundwater level minus groundwater level for action alternative.

The largest groundwater level impacts were associated with areas that have significant direct recharge. These impacts reflect in part that there is a relatively large pool of water for recharge, and that the Recharge Pool has a relatively low priority. The different allocations under the various alternatives particularly affect the size of the Recharge Pool with its lower priority for CAP water. Another factor is that the direct recharge operations tend to result in a relatively intense impact, with large amounts of water being recharged within a limited area. These factors generally account for the substantial impacts in the vicinity of GRUSP in the East Salt River Valley, and the Agua Fria and future westside facilities in the West Salt River Valley. While not driven by the size of the CAP Recharge Pool, direct recharge of CAP water on the San Xavier District of the Tohono O'odham Nation and direct recharge of M&I allocations in direct recharge facilities in the Tucson and Avra Valley areas is also a reflection of the impact of concentrated recharge in a limited geographic area.

For many areas, the demands met are the same for all alternatives, so that the groundwater level impacts are a relatively direct measure of the total impacts of the alternative. However, there are some entities in which the demands differ among alternatives. For example, there are declines in cropped acres for NIA entities that can differ among the various alternatives, reflecting both changing land use (i.e., urbanization) and reductions in cropping due to economic considerations. Those changes in demand can influence the estimated groundwater level impacts. There is a similar situation for the estimated groundwater level impacts on GRIC. The demands can vary among the alternatives, and the assumed portfolio of supplies (in particular the amount of groundwater pumping) used to meet those demands can vary.

III.C. SOCIOECONOMIC RESOURCES

III.C.1. Introduction

This section summarizes the socioeconomic impacts of the proposed CAP allocation on the NIA, Indian, M&I, and power generation sectors. These impacts include NIA lands going out of production and the consequent impacts on the regional economy, Indian lands coming into agricultural production, the cost to the M&I sector of obtaining alternative water supplies to meet the demand of expected population increases, and potential reduced power generation at Glen Canyon Dam.

This section also includes an analysis of CAP repayment and reviews the costs of Indian water rights settlement litigation. In addition, a review of the RRA of 1982 as it pertains to the proposed alternatives is presented in this section. The summary presented in this section focuses on the overall effects. More economic and geographic detail can be found in Appendix D.

III.C.2. Impact Analysis Methodology

III.C.2.a. M&I Sector

Every M&I entity receiving a CAP allocation under one or more of the proposed alternatives was analyzed to determine if the CAP allocation was likely to cause growth. Population projections combined with water use rates specific to each entity formed the basis of projected water demands. The populations projections used were developed by Arizona Department of Economic Security (ADES) independent of water supply availability. The projected water demands were compared to each entity's projected water supplies, as identified in their AWS applications and Water Resource Master Plans. An assessment was made as to whether the entities would be able to meet their projected demands in the absence of the proposed CAP allocation by using existing supplies or by developing alternative supplies. Appendix C provides more detail on the M&I water demand and supply analysis. The costs of developing other supplies to meet the projected demands absent any additional CAP water are estimated based on current costs of developing such supplies. The cost of using CAGRD water as an alternative supply included the cost of pumping groundwater (energy, maintenance, and pump tax) and the cost of joining the CAGRD (currently $188 per af). The costs for the reuse of treated effluent incorporates the costs for building and operating a tertiary treatment facility as well as a secondary, non-potable, water distribution system. Where applicable, a discount rate of 6.875[30] percent was assumed and payments for municipal bonds were assumed over a 25-year period.

III.C.2.b. NIA Sector

There were six points in time considered in the analysis of the NIA sector impacts. These six points are as follows:

- 2001, the beginning of the 50-year study period;

[30] 6.875 percent is the Federal discount rate for long term water projects.

- 2004, the beginning of the CAWCD's new agricultural water pricing and marketing program associated with the Settlement Alternative;

- 2017, the expected termination of the funding for the AWBA program and discontinuance of in-lieu water [31] available to irrigators;

- 2030, the end of CAWCD's current CAP agricultural water marketing and pricing program;

- 2043, the time when shortage conditions are assumed to exist on the Colorado River in which CAP deliveries decrease from 1.4 mafa under normal conditions on the Colorado River to 925,000 afa under shortage conditions; and

- 2051, at the end of the 50-year study period.

To project the magnitude and timing of potential changes to NIA production, the viability of representative crops was analyzed given water availability and costs under the proposed alternatives that were considered in this draft EIS. In this analysis, viability was determined by evaluating the difference between the revenues generated from specific crops and the variable costs of producing those crops, including water costs. When revenues are not sufficient to cover variable costs, it was assumed that the crop would no longer be produced.

This analysis highlights the effect of changes in water cost and availability on changes in irrigated agricultural land. The effects of changes in crop prices, non-water costs of agriculture, and other economic variables are muted by holding agricultural commodity prices and non-water costs constant. In particular, prices for crops were assumed to stay at recent levels in constant (inflation adjusted) dollars. Non-water production costs for crops were assumed to stay at levels estimated in University of Arizona crop budgets (in constant dollars[32]). Crop yields per acre were assumed to stay at recent (1993-1997) levels.

Groundwater pumping costs were based on historical pumping costs in each of the nine NIA districts that would be affected under one or more of the action alternatives, modified by the groundwater lifts estimated in the groundwater analysis (see Appendix I). Groundwater pumping costs vary greatly even within the NIA districts due to varying depths to the water table and due to variations in the use of gas and electricity to run the pumps. Groundwater pumping costs were estimated using the groundwater declines predicted by the groundwater model (see Appendix I). Pool One[33] CAP water prices were assumed to remain constant over the 50-year study period (in constant dollars) under all proposed alternatives. Pool Two and Pool Three prices are different than Pool One prices, but Pools Two and Three are available only in the early years of the 50-year study period. Details on water prices are provided in Appendix D.

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[31] As described in Chapter I, in-lieu water refers to surface water delivered to farmers, who use the surface water in-lieu of groundwater, which would otherwise be pumped.

[32] University of Arizona, College of Agriculture, Department of Agricultural and Resource Economics, *Arizona Field Crop Budgets 1999-2000* for various Counties, Extension Bulletins #AZ1121, #AZ1120, #AZ1118, #AZ1115; and *1998-99 Arizona Vegetable Crop Budgets* for various regions within the State, Extension Bulletins #AZ1103, #AZ1102.

[33] CAWCD currently has a structure of three Ag Pools (Pool One, Pool Two and Pool Three) with varying eligibility and pricing. More detail may be found in Appendix M.

Decreases in NIA production constitute the “first round regional economic impacts” of the alternatives. Over time these first round impacts would lead to subsequent rounds of regional economic impacts. For example, the first round impacts would lead to decreases in the purchase of farm inputs such as chemicals, machinery, and labor from within the three-County area (i.e. Maricopa, Pima and Pinal Counties). These decreases in turn would lead to decreases in purchases by suppliers of agricultural chemicals, sellers of agricultural machinery, manufacturers of agricultural machinery, and purchases by workers who otherwise would have earned income from farm work. These impacts on the three-County region were analyzed using IMPLAN, a regional economic impact model. Technical detail on the regional economic impact analysis and the IMPLAN model are found in Appendix D. The sum of the impacts over all rounds of regional economic repercussions is called the total regional economic impact in this draft EIS[34].

III.C.2.c. Indian Sector

In general, the economic analysis of impacts on the Indian sector was similar to the analyses completed for NIA users. Greater availability of CAP water supplies on some Indian Reservations is expected to lead to more land under cultivation. The impacts of bringing Indian lands into agricultural production were estimated assuming cropping patterns similar to those found in the NIA sector, as described in Appendix D. Crop yields and prices are assumed to be constant throughout the 50-year study period for all alternatives, as explained above. Regional economic impacts were also analyzed using the IMPLAN model. Crop yields and prices used in this analysis are from the same sources as used in NIA analysis.

III.C.2.d. Power Generation Sector

The economic impact of reducing water through the turbines at Glen Canyon Dam was analyzed by estimating lost power production at Glen Canyon and assuming that the lost power would be replaced by more expensive spot market energy purchases and associated transmission service. It was assumed that water allocated to the Navajo Nation and Hopi Tribe under Non Settlement Alternatives 2 and 3 would be diverted from Lake Powell and would occur at a constant rate of 20 cubic feet per second (cfs). More detail on the methodology may be found in Appendix J.

III.C.2.e. CAP Repayment

The allocation of CAP water to various users over the repayment period is an important determinant of the repayment obligation assigned to CAWCD for the CAP’s construction. In the draft EIS, the proposed alternatives represent varying allocations of CAP water to different uses. Different water allocations result in different financial obligations. Therefore, a cost allocation and repayment analysis was conducted for each scenario. The full cost allocation model was not

[34] Regional economists usually call the first round regional economic impact the “direct impact.” Subsequent rounds of impacts are usually called “indirect and induced impacts.” The discussion in Appendix D uses these terms, but for clarity for the non-technical reader, and to maintain consistency with the definition of direct and indirect impacts presented in the Introduction to Chapter 3, this chapter uses the terms first round and subsequent round regional economic impacts.

employed; instead, a spreadsheet approximation on Excel software, known as the "mini-model," closely approximates the results of the more detailed official model for cost allocations. This model is discussed in more detail in Appendix K.

III.C.2.f. RRA

The analysis of the relationship between the RRA and the proposed alternatives was conducted by reviewing the relevant portions of the statute in light of the provisions of the Settlement Alternative.

III.C.2.g. Indian Water Rights Settlement Litigation Costs

The costs of litigating water rights claims were taken from a Memorandum prepared by the Chairman of the Steering Committee for Gila River Adjudication dated October 22, 1993[35]. Although this Memorandum is an incomplete record of costs associated with the adjudication, which began about 20 years prior to the preparation of the Memorandum, it provides a rough guide as to the magnitude of resources put toward a litigation approach to resolving conflicting water rights claims.

III.C.3. Affected Environment

III.C.3.a. M&I Sector

Current cost for CAP water treated to potable standards is estimated to be approximately $154 per af, as shown in Appendix L.

III.C.3.b. NIA Sector

In 1997, farming and agricultural services accounted for $1.934 billion of the State's gross state product[36]. Also in 1997, farming and agricultural services accounted for $881 million in compensation to employees[37]. However, Arizona is predominantly a non-agricultural state. Total gross state product in 1997 was $121.2 billion and total compensation of employees was $69.2 billion. Figure III-12 shows the distribution of gross state product by sector in 1997. Manufacturing, trade, services, and government are all large components of the Arizona economy. The sector labeled FIRE is the Finance, Insurance, and Real Estate sector. Additional discussion of agriculture is included in the Land Use section of this chapter.

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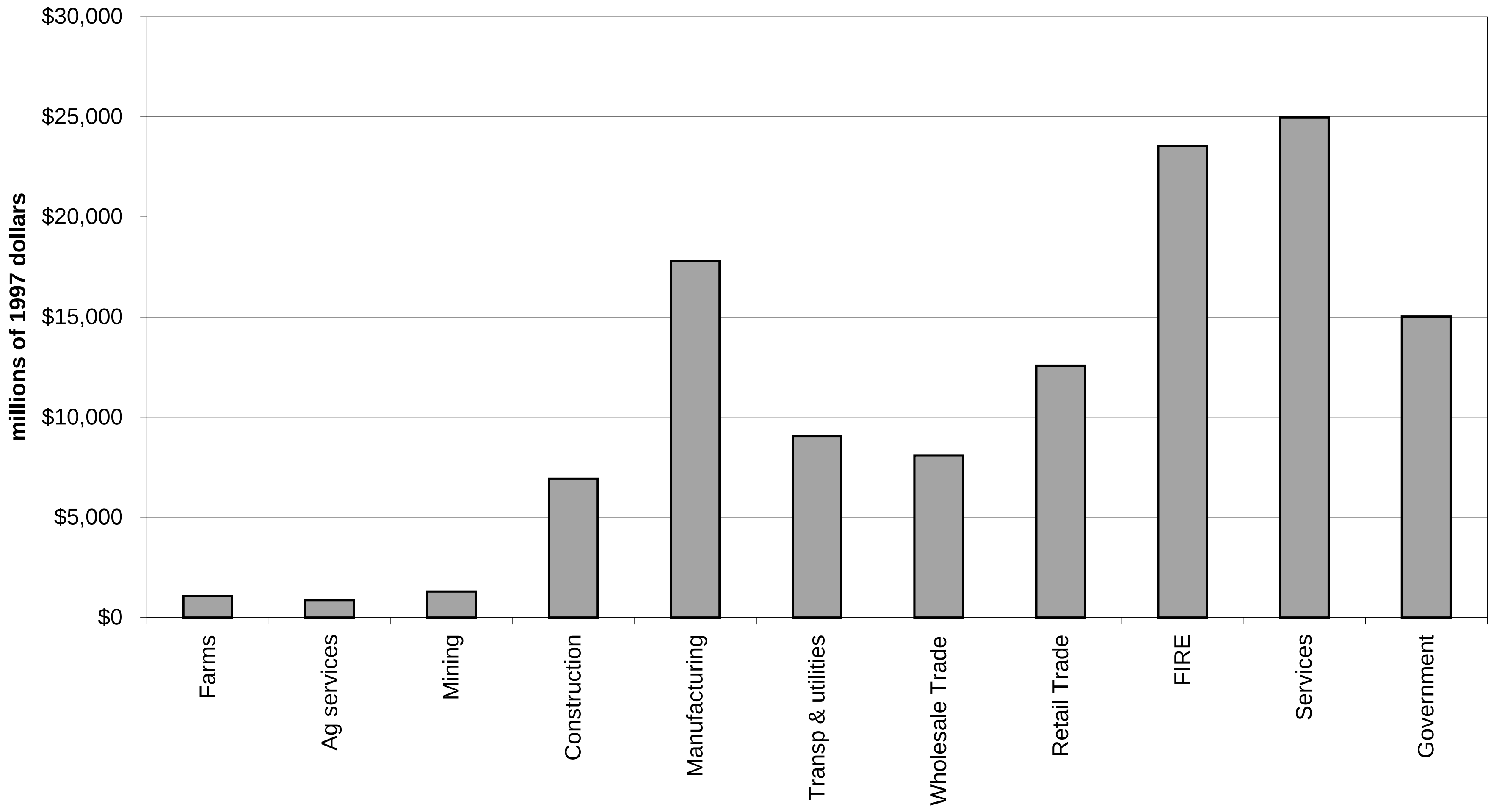
[35] Memorandum to the Steering Committee, Gila River Adjudication.

[36] Data are from the Bureau of Economic Analysis. Gross state product is the sum value added originating in all industries in the state. Value added is gross output (sales or receipts and other operating income, commodity taxes, and inventory change) minus intermediate inputs (consumption of goods and services purchased from other U.S. industries or imported).

[37] Bureau of Economic Analysis.

Figure III-12
CAP Allocation Draft EIS
1997 Arizona Gross State Product by Sector
Total = $121,239 million



III.C.3.c. Indian Sector

Additional Indian agricultural activity resulting from proposed allocations would increase incomes for a population that generally experiences low income[38] and high unemployment rates. For those Indian Tribes receiving priority CAP water for M&I use, i.e., the Navajo Nation and Hopi Tribe, water costs may decrease, thereby making economic development more attractive. Figure III-13 shows the 1999 average unemployment rates by Reservation according to data compiled for the Arizona DES. All the Reservations shown in the Figure had much higher unemployment rates than the state as a whole.

III.C.3.d. Power Generation

Lake Powell is behind Glen Canyon Dam, and water from Lake Powell flows through turbines at Glen Canyon Dam to generate electricity. An allocation to the Navajo / Hopi Reservations could result in withdrawal of about 13,500 afa from Lake Powell. Water withdrawn from Lake Powell would not flow through the hydroelectric turbines and some electric generation would, therefore, be foregone.

III.C.3.e. CAP Repayment

In 1998, Reclamation revised the Interim Final Cost Allocation for the CAP for Stages I and II, dated December 1996. The date of the revised cost allocation, also known as Revised CASII, is September 1998. Revised CASII is the latest official cost allocation of the CAP. Under Revised CASII, the estimated repayment obligation assigned to CAWCD is $2,182,532,000.

III.C.3.f. RRA

With the RRA (PL 97-293, 96 Stat. 1261, Title II, as amended), Congress broadened Reclamation's empowerment from building and managing waterworks on the supply side, to ensuring Federal water was being put to reasonable and beneficial use on the demand side[39]. The RRA addresses the ownership and leasing of land in Reclamation irrigation projects and the pricing of project irrigation water. It further establishes terms and conditions for the delivery of project irrigation water. The RRA imposes ownership and pricing limitations on districts that have a contract with Reclamation. Landholders are required to certify or report their landholdings as part of their compliance with the RRA. Each year, irrigation districts (IDs) must summarize these certifications and reporting forms and provide the information to Reclamation, which oversees the districts' implementation of the RRA rules and regulations. The RRA limits benefits from Reclamation projects to participants in those projects.

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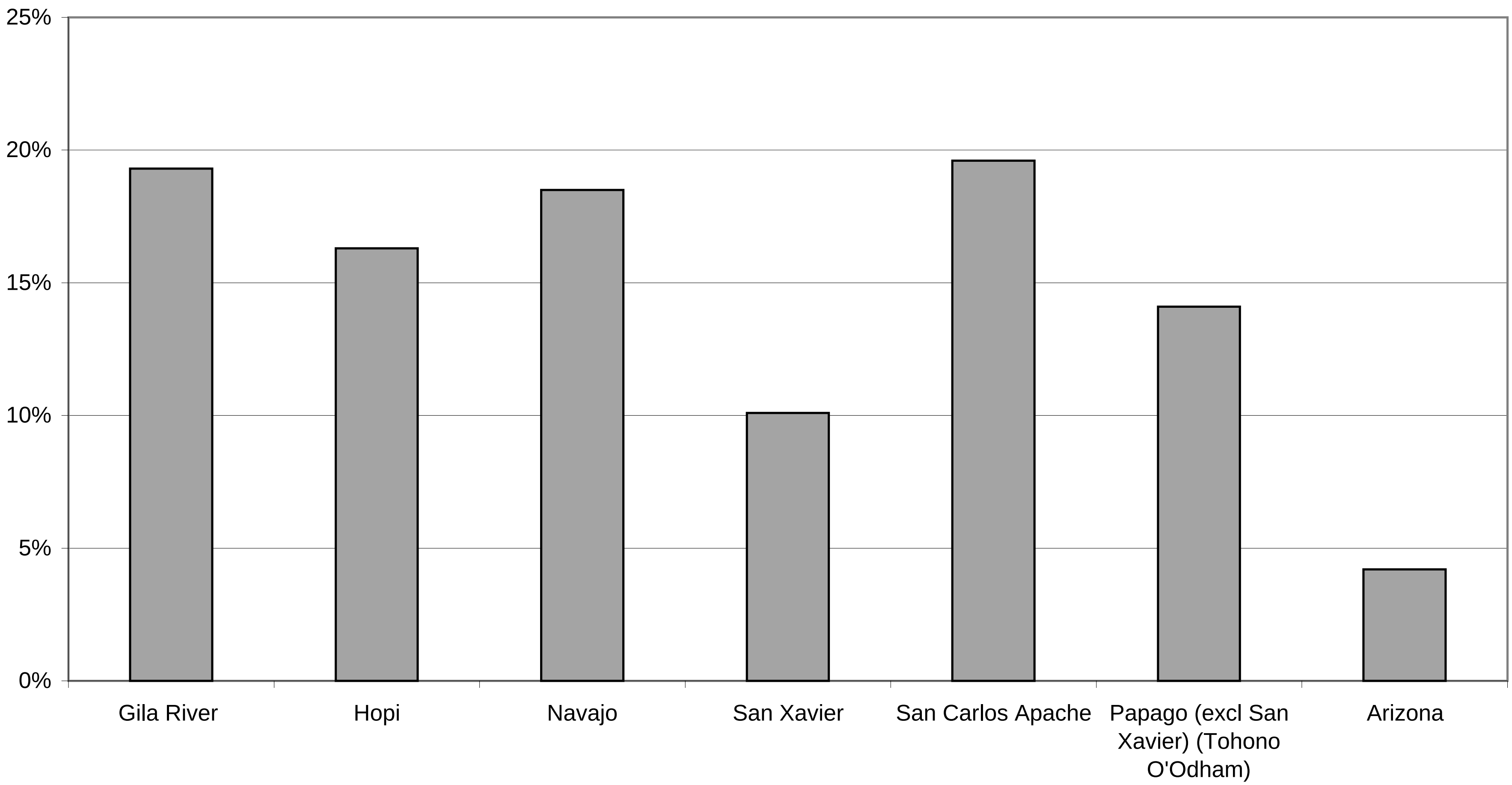
[38] 1990 Census data for Indian Tribes clearly indicate lower incomes per capita, per household, and per family for Indians relative to the general population.

[39] This description is taken from Reclamation's web site 209.21.235 / documents / index.htm.

Figure III-13
CAP Allocation Draft EIS
1999 Unemployment Rates:
Indian Reservations and State of Arizona
Source: Arizona DES



With regard to CAP water, the RRA imposes the following:

- ♦ Land that exceeds a landowner's maximum ownership entitlement (excess lands) cannot receive CAP irrigation water (except surplus water in certain circumstances) at any price;

- ♦ Lands ineligible for other reasons may not receive any CAP water at any price;

- ♦ Land leased over 960 acres or owned by limited recipients (entities benefiting more than 25 natural persons) under most circumstances may receive CAP water at the full cost rate;

- ♦ The full cost rate of CAP water is required for delivering CAP water to ineligible lands (this would make CAP water costs sufficiently high such that its use for agriculture on ineligible lands would be economically prohibitive).

- ♦ Groundwater delivered through the CAP distribution system requires a commingling contract and is subject to a commingling fee; MSIDD and CAIDD have commingling agreements.

Commingled water is groundwater delivered via a federally-funded distribution system and is not Reclamation irrigation water. Commingled water may be delivered to CAP ineligible lands. The commingling fee is equal to the Federal interest subsidy for the proportion of the irrigation distribution system facilities used to deliver commingled water. Otherwise, irrigation districts pay no interest on their federally-funded water distribution system loans. Over the period 1989 through 1997, the CAIDD took 140,230 af of commingled water at a cost of $562,323[40]. Over the same period, the MSIDD took 398,222 af of commingled water at a cost of $1,478,291.

Currently, in the CAP there are approximately 38,258 acres of excess land. Excess is defined as nonexempt land that is in excess of a landowner's maximum ownership entitlement under the applicable provisions of Federal reclamation law. Excess land by irrigation district is shown in Table III-2.

The majority of these lands could be made non-excess and eligible for project water under Reclamation’s sale price approval process. If a landholder has purchased land that has been designated excess by the previous owner and these lands would fit in the new owner’s 960-acre entitlement, they can be made eligible through this sales price approval process.

[40] Represents commingling fee only. CAIDD had additional costs to pump the water that are not included in this cost.

Table III-2
CAP Allocation Draft EIS
Excess Land Under the RRA

Irrigation District	Excess Land (acres)
Chandler Heights Citrus ID	67
CAIDD	11,067
Harquahala ID	12,722
HIDD	1,049
MSIDD	10,200
New Magma IDD	2,439
Queen Creek ID	585
San Tan ID	78
Tonopah ID	51
Total	38,258

IDs and other parties contend that the RRA does not coincide with the goals of the CRBPA and the State of Arizona GMA of 1980, to use CAP water to decrease groundwater pumping. They contend that the RRA discourages the use of CAP water and, therefore, encourages the use of groundwater, which the CAP was meant to limit.

III.C.3.g. Indian Water Rights Settlement Litigation Costs

On October 22, 1993, The Chairman of the Steering Committee for Gila River Adjudication assessed the costs of Indian water rights settlement litigation costs[41]. The 1993 review identified the following costs associated with the adjudication of Indian water rights:

- ♦ The United States had spent about $16 million on the Gila River Adjudication since 1974.
- ♦ The ADWR and its predecessor agencies had spent between $20 million and $25 million.
- ♦ The Arizona State Lands Department (ASLD) had spent $7 million.
- ♦ Four municipalities had spent about $4 million.

The total costs through 1993 also included costs incurred by mines, utilities, IDs, water association, water companies and others, but cost data were not available.

The Chairman of the Steering Committee concluded that "Significant expenditures by all parties will continue into the future and can be expected to increase significantly as litigation begins in earnest."

[41] Memorandum to the Steering Committee, Gila River Adjudication.

III.C.4. Environmental Consequences

III.C.4.a. M&I Sector

All of the M&I entities potentially receiving a CAP allocation are estimated to be able to meet their projected demands, with or without the additional CAP allocation. (See Appendix C.)

III.C.4.a.(1) No Action Alternative

For all the M&I entities evaluated, the projected demands were estimated to be met through the development of alternative water supplies, including joining the CAGRD and treating and using reclaimed water. These alternative supplies, however, would be more costly than using the proposed CAP allocations. For example, treated CAP water costs are approximately $154 per af, joining the CAGRD costs approximately $214 to $301 per af (depending on the depth to groundwater), and reclaiming effluent for use on turf facilities costs approximately $237 per af (this cost includes a secondary distribution system). Within reason, M&I water demand is relatively insensitive to water rates and it is recognized that increased water costs would likely be passed on to consumers via rates, resulting in potentially decreased spending on household discretionary items such as recreation. These secondary impacts were not quantified. Specific M&I water-related construction projects were also not quantified for inclusion in the IMPLAN model. Entity specific details may be found in Appendix L.

III.C.4.a.(2) Settlement and Non-Settlement Alternatives

Under the Settlement Alternative, Non-Settlement Alternative 1 and Non-Settlement Alternative 3B, the cost of water would be less than under the No Action Alternative, since the M&I entities would receive a CAP allocation and would have less of a need to develop alternative water supplies. Non-Settlement Alternative 2 and Non-Settlement Alternative 3A would be the same as under the No Action Alternative.

III.C.4.b. NIA Sector

Forecasts were made of NIA acreage changes over the 50-year study period, and the corresponding groundwater and CAP water usage for all of the alternatives, including the No Action Alternative. The results are shown in Figures III-14 through III-16. NIA CAP water use in Figure III-15 includes use of in-lieu water. Where acreage would diminish over time, the decrease pertains to those crops whose production is highly sensitive to water costs, such as forage and grains. The acreage of other crops, such as vegetables, melons, and citrus, which are not as sensitive to water prices, is not expected to decrease over the 50-year study period. The production of vegetables, fruit, or other high value crops is restricted by the size of the national market. Presently, farmers in central Arizona are producing high value crops to the maximum extent that markets will bear, based upon an evaluation of specialty crop acreages farmed in Arizona over the past 20 years. Therefore, there appears to be no opportunity to substantially increase specialty crops acres as more traditional field crop acres decrease.

Figure III-14
CAP Allocation Draft EIS
NIA Irrigated Acreage

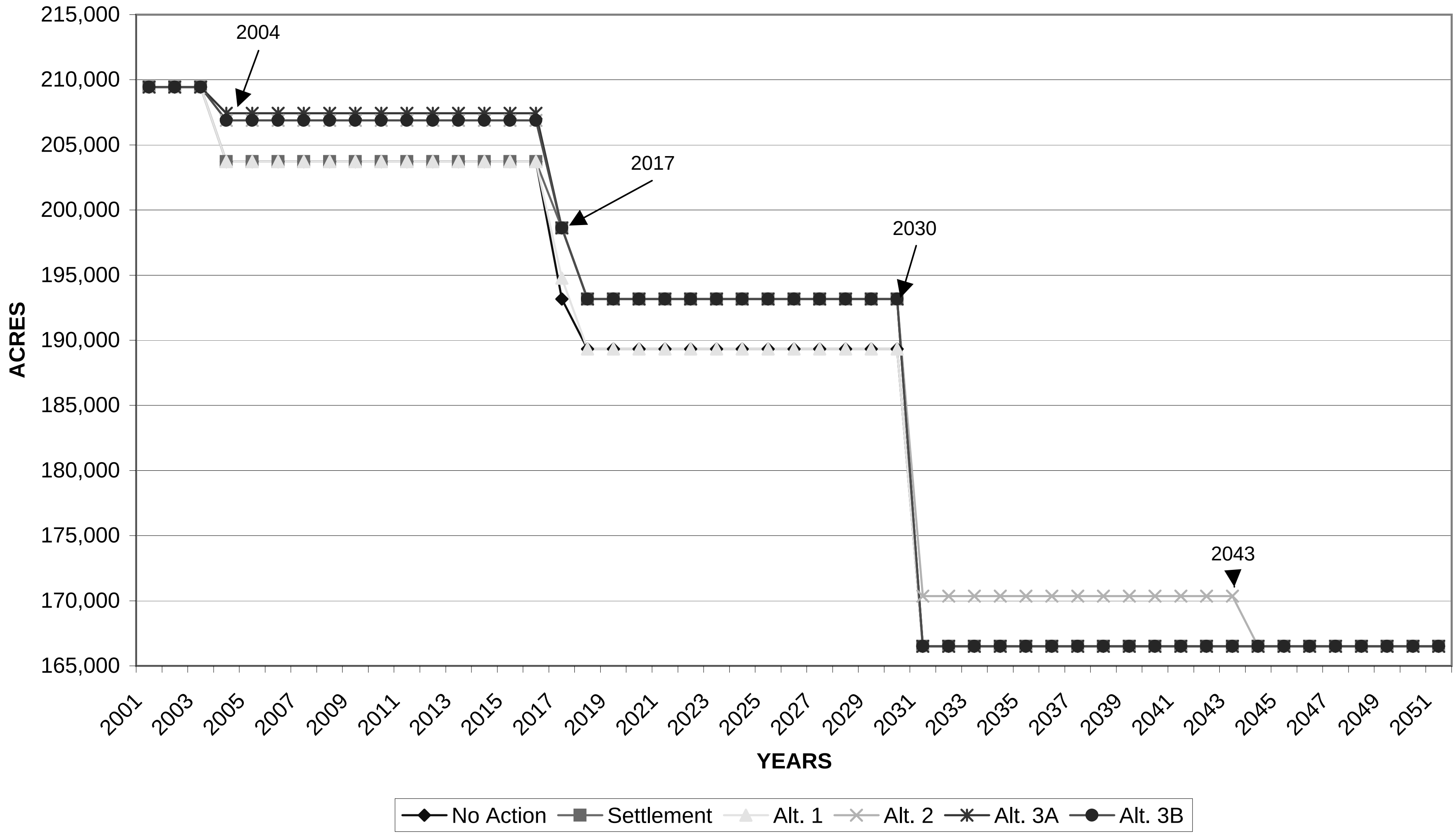


Figure III-15
CAP Allocation Draft EIS
NIA CAP Water Use

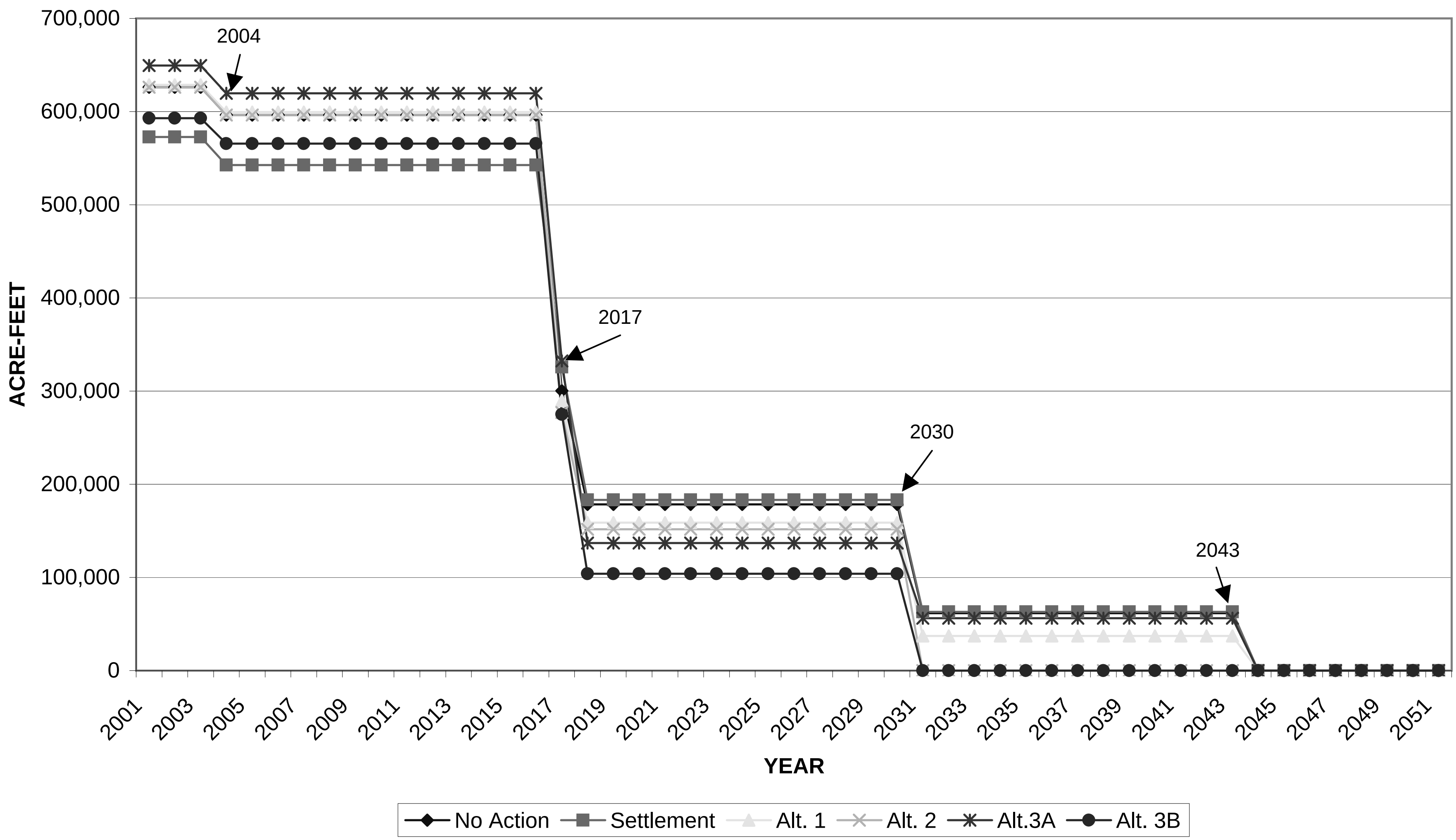
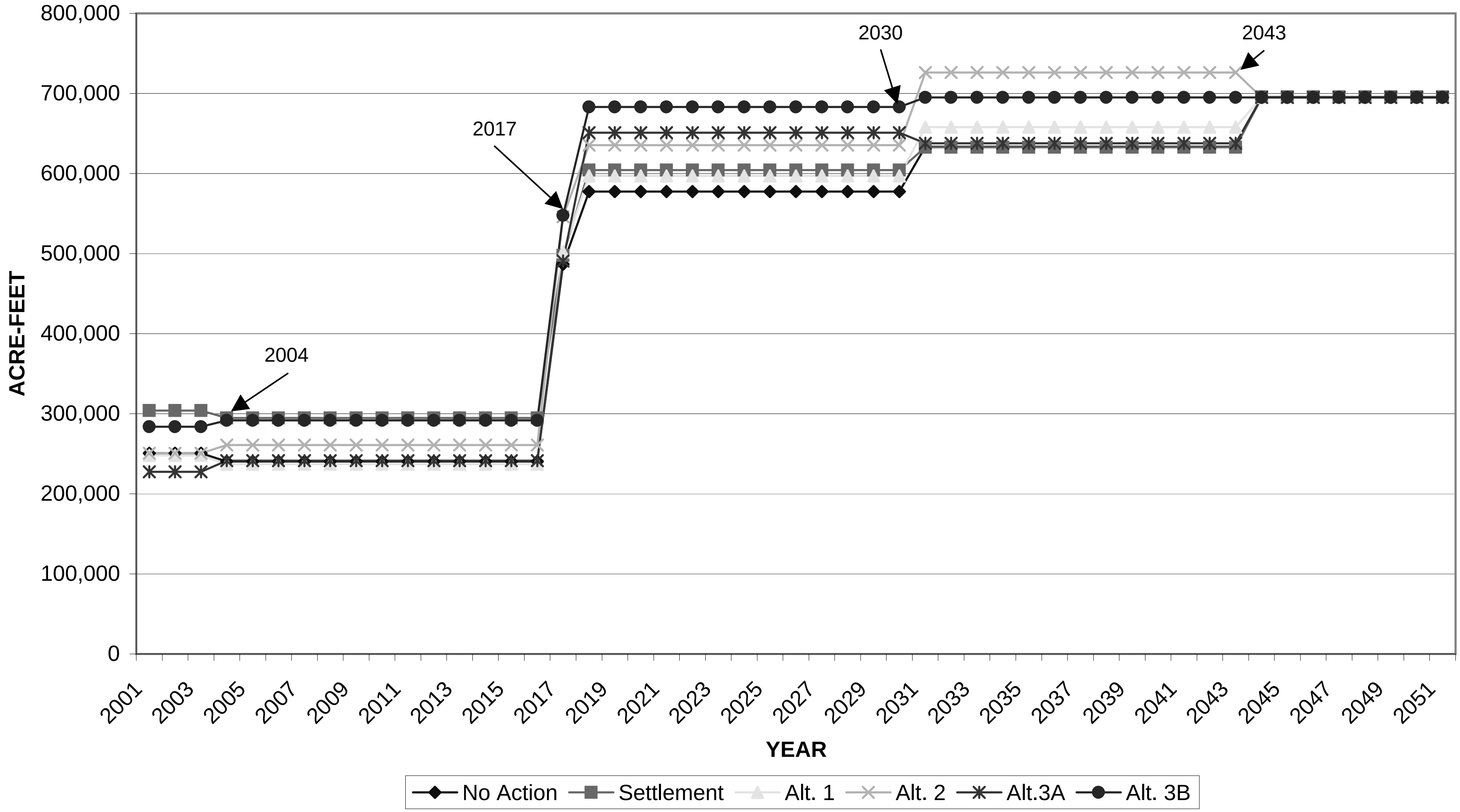


Figure III-16
CAP Allocation Draft EIS
NIA Groundwater Use



Agricultural acreage is expected to decline as CAP water diminishes over time, leaving farmers with a choice of using more groundwater or retiring the land. It is assumed groundwater would be used as long as its cost does not make farming a particular crop uneconomical. Rising groundwater costs in some districts would render some crops uneconomical and the analysis indicates that those crops would no longer be grown. As a result, NIA acreage would decline.

The acreage farmed, groundwater, and CAP water patterns are interrelated. Overtime, NIA acreage would decline due to decreasing availability of CAP water. The cost to use groundwater, a substitute for CAP water, would increase over time due to higher pumping costs. The higher water cost is expected to cause some crops to be taken out of production because the revenues from the sale of those crops would no longer cover the variable costs, including water costs, of producing those crops. Groundwater pumping costs vary from district to district so the effect of declining CAP water would not be spatially uniform. There would be no declines in agricultural acreage over time under any alternative in MSIDD, but there would be declines in acreage under all alternatives in the other districts. Details by district are presented in Appendix D.

For the nine NIA districts combined, the amount of farmed acreage and water use patterns would be similar under all alternatives. The underlying reason is the similarity in water availability under each action alternative. In every study year, the difference between the largest and smallest CAP NIA Ag Pool size across the alternatives is less than 80,000 af (including in-lieu water).

With regard to NIA acreage, the same amount of acreage would be farmed by all entities in 2001 under each action alternative. And, the amount of acreage that is farmed among the alternatives in 2051 would also be the same. In the intervening years, the No Action Alternative results in irrigated acreage as low as under any action alternative.

With regard to CAP water availability (including in-lieu water use), among all the alternatives, the Settlement Alternative would result in less CAP water availability for NIA uses in the early years. However, for the 50-year period, the Settlement Agreement would result in CAP water availability for NIA use that is the highest among the alternatives.

Finally, with regard to groundwater consumption, the Settlement Alternative would result in the highest groundwater use of any action alternative in 2001 and 2004. In 2017 and 2030, groundwater usage under the Settlement Alternative is expected to fall in the middle of the range of alternatives. In 2043, the Settlement Alternative would result in the lowest groundwater use of any alternative.

First round regional economic impacts of declining NIA production are displayed in Table III-3 in terms of changes in output. These impacts reflect only the decreases in agricultural output consistent with the decreases in NIA acreage described above. In general, NIA exhibits negative first round regional economic impacts because agricultural acreage is expected to decline. These first round regional economic impacts associated with the NIA sector are greatest under the Settlement Agreement and often (but not always) smallest under the No Action Alternative. Total regional economic impacts are discussed below in the section on the Indian sector.

Table III-3 CAP Allocation Draft EIS First Round Economic Impacts on Three-County Area					
NIA					
Millions of dollars worth of changes in output (2,000 dollars)					
Year	Settlement Alternative	Non-Settlement Alternative 1	Non-Settlement Alternative 2	Non-Settlement Alternative 3A	Non-Settlement Alternative 3B
2001	$0.0	$0.0	$0.0	$0.0	$0.0
2004	-$2.8	$0.0	$0.0	$0.0	$0.0
2017	-$3.5	-$0.5	-$1.9	-$1.9	-$1.9
2030	-$10.0	-$4.3	-$8.4	-$10.0	-$16.8
2043	-$10.0	-$8.4	-$10.0	-$10.0	-$10.0
2050	-$5.1	-$1.6	$0.0	$0.0	$0.0

III.C.4.b.(1) No Action Alternatives

Under the No Action Alternative, the amount of land farmed in the NIA sector would decline about 43,000 acres over the period 2001 to 2051. The dollar value of the expected decline in NIA activities (first round impacts only, in 2000 dollars) would be $23.6 million in the year 2051. In 1997, the value of all farm sales in Arizona was $1.9 billion[42], so the decline, while locally important, would be a small fraction of agricultural activity Statewide. Forecasts for individual NIA districts can be found in Appendix D.

III.C.4.b.(2) Settlement and Non-Settlement Alternatives

Under the action alternatives, it is anticipated the decline in NIA acreage, comparing year 2001 and year 2051, would be the same as under the No Action Alternative. However, the rates of decline vary among the alternatives. (See Appendix D for district specific forecasts.)

III.C.4.c. Indian Sector

III.C.4.c.(1) No Action Alternative

The No Action Alternative represents the baseline for the draft EIS. Detailed forecasts of the amounts of acreage farmed on Indian lands are provided in Appendix D. Under the No Action Alternative, allocation of CAP water to the Navajo/Hopi for M&I uses would not occur.

III.C.4.c.(2) Settlement and Non-Settlement Alternatives

Figures III-17 and III-18 indicate incremental increase in Indian agriculture acreage and associated CAP water use at the time of build-out for Indian agricultural activities, relative to the No Action Alternative. As stated later in this section, the GRIC and TON would all be developed for agriculture by the year 2040. These figures report only the impacts attributable to changes in CAP allocations and do not include changes due to other water supply usage.

[42] 1997 Census of Agriculture, Arizona, Table 2.

Figure III-17
CAP Allocation Draft EIS
Incremental Indian Agricultural Acreage at Build-Out Attributable to CAP Allocations

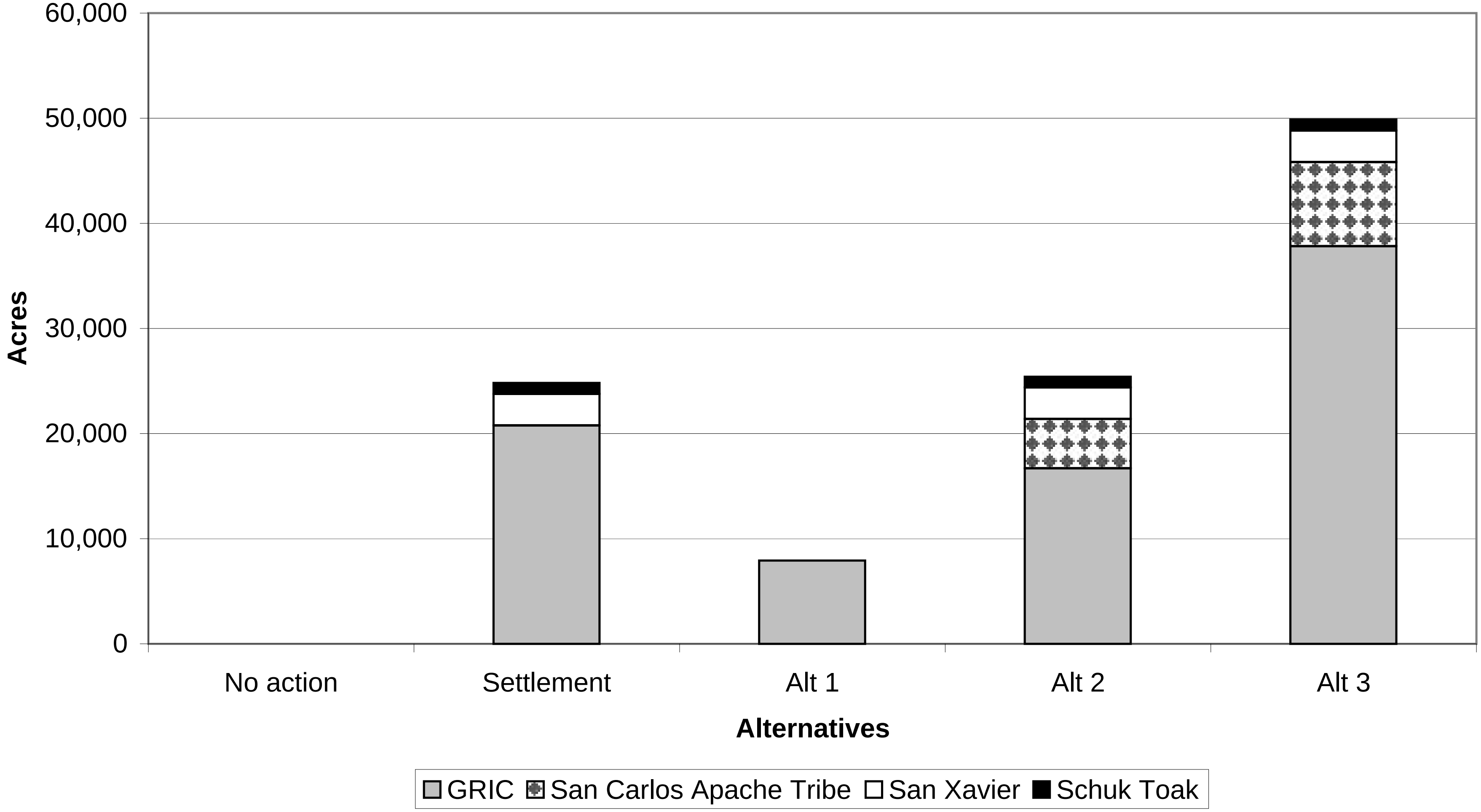
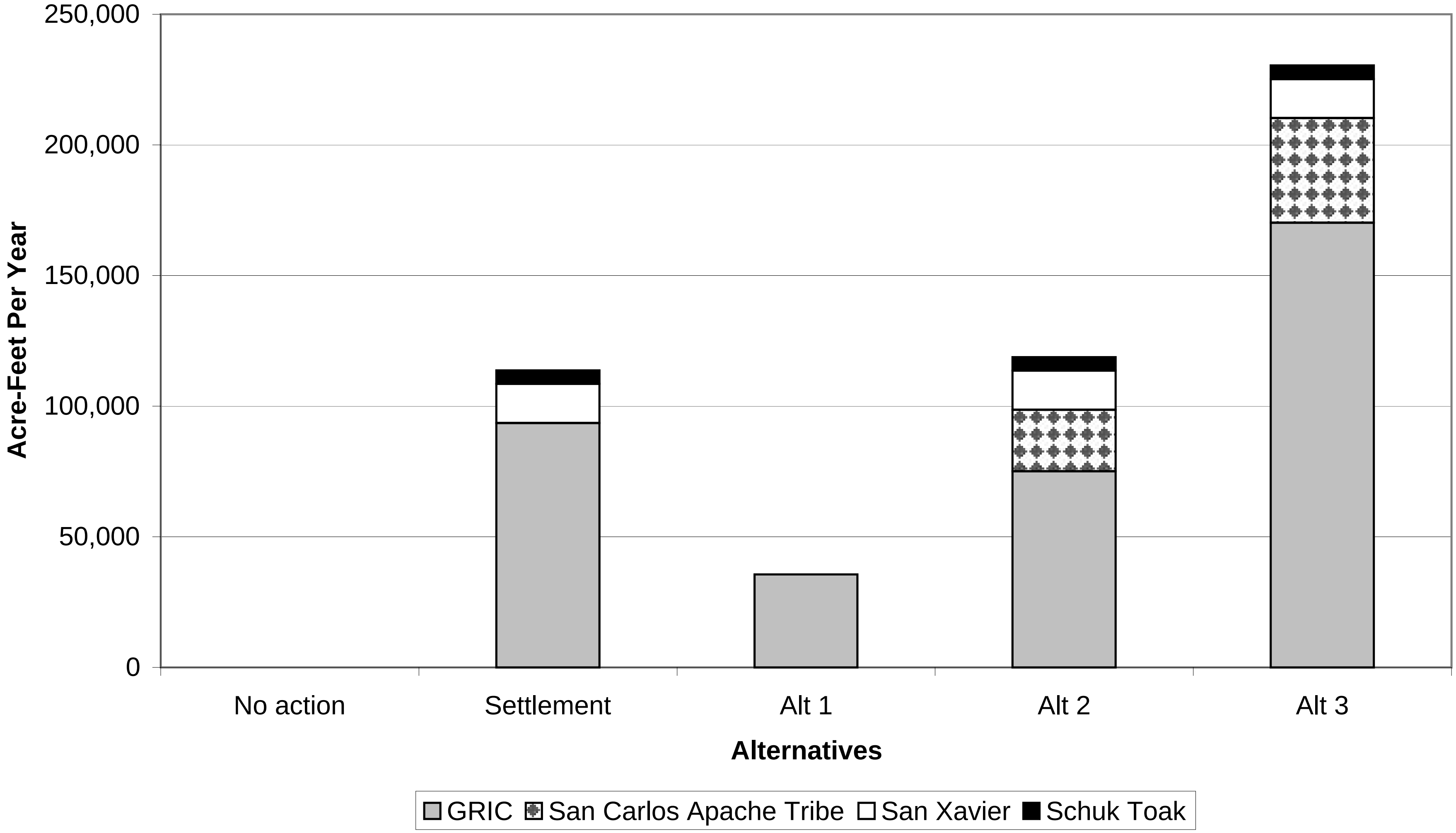


Figure III-18
CAP Allocation Draft EIS
CAP Water Usage for Indian Irrigation at Build-Out



Under every action alternative, the largest impact is on the GRIC. Non-Settlement Alternative 1 results in the least amount of agriculture being developed of all the alternatives except the No Action Alternative. Non-Settlement Alternative 3 results in the greatest amount of land used for agriculture for the GRIC and the SC Apache Tribe.

In addition to the impacts on Indian agriculture shown in the figures, Non-Settlement Alternatives 2 and 3 provide for withdrawal of about 13,500 afa from Lake Powell for M&I use on the Navajo / Hopi as delivered via pipeline.

First round regional economic changes due to increasing agricultural production on the Indian lands are displayed in Table III-4 in terms of changes in output. More detail can be found in Appendix D. The first round impacts on the three-County area consist of the changes in the value of Indian agricultural output relative to current levels of output. Indian agriculture exhibits positive first round regional economic impacts on the region because agricultural acreage is expected to increase. First round regional economic impacts associated with the Indian sector are greatest under Alternative 3 and smallest under the No Action Alternative.

Table III-4
CAP Allocation Draft EIS
First Round Economic Changes in Output for Three-County Area
INDIAN AGRICULTURE
Millions of dollars worth of changes in output (2000 dollars)

	Settlement Alternative	Alternative 1	Alternative 2	Alternative 3A	Alternative 3B
2001	$0	$0	$0	$0	$0
2004	$0	$0	$0	$0	$0
2017	$0	$0	$0	$0	$0
2030	$32.4	$7.6	$18.3	$50.1	$50.1
2043	$32.4	$7.6	$18.3	$50.1	$50.1
2050	$32.4	$7.6	$18.3	$50.1	$50.1

Source: Reclamation calculations

As Indian lands are converted to agricultural use, water distribution systems would need to be constructed. Table III-5 shows the impacts on output, employment and income of constructing Indian distribution systems for those study years during which construction is expected to occur. The Federal expenditures for Indian distribution systems are currently on-going and will continue through about 2012. The GRIC settlement currently contemplates an additional amount of $200 million, disbursed at the rate of $25 million annually for 2001 through 2008. This expenditure occurs only under the Settlement Alternative, and would be used for agricultural development on the Reservation.

Table III-5
CAP Allocation Draft EIS
Study Year Impacts of Construction of Indian Distribution Systems

	Settlement Alternative		All Other Alternatives	
	First Round Impacts	Total Impacts	First Round Impacts	Total Impacts
Construction Expenditures (million $)				
♦ 2001	$25.0	$40.3	$0	$0
♦ 2004	$25.0	$40.3	$0	$0
Employment (jobs)				
♦ 2001	218	420	0	0
♦ 2004	219	421	0	0
Income (million $)				
♦ 2001	$8.8	$17.1	$0	$0
♦ 2004	$8.8	$17.1	$0	$0
Source: Reclamation estimates				

III.C.4.d. Power Generation Sector

No water would be diverted from Lake Powell under the No Action Alternative, Settlement Alternative, and Non-Settlement Alternative 1, and no changes in power generation at the Glen Canyon Dam would occur.

Under Non-Settlement Alternative 2 and Non-Settlement Alternative 3A and 3B, there would be a withdrawal of 13,500 afa of water from Lake Powell for Navajo / Hopi M&I use. This withdrawal would reduce energy production at Glen Canyon Dam by about 7,148 megawatt hours (MWh) per year. (One MWh equals 1000 kilowatt hour (kWh)). Replacing this foregone energy production with spot market purchases and associated transmission services would cost about $226,000 per year. This dollar amount is about 0.19 percent of the value of electric energy produced at Glen Canyon Dam annually. Over the 50-year study period, assuming the water diversions start in 2001, the present value of foregone energy production is $7.8 million. Details on the analysis are presented in Appendix J.

III.C.4.e. CAP Repayment

CAP construction costs are costs allocated to non-Indian and Indian irrigation, commercial power, M&I water, fish and wildlife, recreation, and flood control. Changes in CAP water allocation do not significantly affect the allocation of costs to commercial power, fish and wildlife, recreation, and flood control. Changes in CAP water allocation do, however, impact the costs assigned to non-Indian and Indian irrigation and M&I water supply. The total project construction cost is just under $5 billion and includes all expenditures by the United States in constructing the CAP plus interest during construction.

The CAWCD is the primary repayment entity for the CAP. Under the Settlement Alternative, CAWCD's repayment obligation is $1.650 billion, a fixed, negotiated number. Under the No Action

Alternative, CAWCD's repayment obligation is calculated to be $2.183 billion[43], based on the CASII repayment anaysis. The difference between total project costs and the portion which is to be repaid by local beneficiaries becomes construction costs that are not recovered by the United States through repayment. The difference in cost to the United States between the Settlement Alternative and the No Action Alternative, in terms of a reduction in the repayment amount, is about $500 million. In addition, CAWCD would experience an approximate reduction of $450 million in interest payments to the United States over the repayment period.

For Non-Settlement Alternatives 1, 2, 3A, and 3B, the repayment obligation is established to be $2.183 billion, $1.964 billion, $1.833 billion, and $1,897 billion, respectively.

III.C.4.f. RRA

Under the No Action Alternative, it is assumed that all provisions of the RRA would remain in effect. ID landowners would continue to file certification forms and be subject to the excess acreage and full cost pricing provisions of the RRA. Certain lands would continue to be ineligible for project water delivery and commingling fees would continue. Reclamation and the IDs would still need to maintain staff and would incur costs administering the RRA program.

Under the Settlement Alternative, it is expected that CAP irrigation districts would be provided some degree of relief from the acreage limitation and full cost pricing provisions of RRA. If full relief was provided by Congress, Reclamation irrigation water could be delivered to all CAP irrigation district lands without the ownership and leasing limitations and full cost charges. This exemption would render formerly excess lands and land owned by limited recipients eligible to take delivery of Reclamation irrigation water. No full cost charges would be assessed, removing the possibility of having to pay high full cost rates for delivery of Reclamation irrigation water to ineligible lands. In MSIDD and CAIDD, commingling fees for delivering non-project groundwater would be eliminated. All of these changes together may make farming more profitable, and potentially increase the use of CAP water and reduce groundwater pumping. Furthermore, agricultural irrigation districts, individual farmers, and the United States would no longer incur administrative costs associated with the implementation, fulfillment, and oversight of the RRA program. In addition, administrative costs related to implementing the RRA program would be eliminated. In particular, NIA districts, individual farmers and the United States would no longer incur RRA-related administrative costs. The Phoenix Area Office of Reclamation has three full-time positions that administer the RRA for CAP.

Under the non-settlement alternatives, the RRA would remain in effect, and conditions would be as described for the No Action Alternative.

[43] It is noted that in *CAWCD vs. United States*, the Court ruled in its Phase One decision that the repayment ceiling is $1.781 billion, absent an amendatory contract. In order to provide a basis of comparison, the repayment obligation shown for all Non-Settlement Alternatives is based solely on costs resulting from changes in water allocation.

III.C.4.g. Indian Water Rights Settlement Litigation Costs

Under the No Action Alternative, it is assumed ongoing litigation would continue among numerous Indian Tribes, the United States on behalf of the Tribes, the State of Arizona, and municipalities, along with the attendant litigation costs.

The Settlement Alternative would avoid millions of dollars in future litigation expenditures. In particular, under the Settlement Alternative, the expense of continuing litigation would conclude. The potential savings, relative to the other alternatives, is millions of dollars, but the precise amount cannot be determined. The Chairman of the Steering Committee, Gila River Adjudication, stated that "The premise of [settlement approaches] is that if the principal Indian claims in the Gila River watershed can be settled, there is very little purpose in proceeding further with the litigation…."

Under Non-Settlement Alternatives 1, 2, 3A, and 3B, Indian water rights settlement litigation costs would continue as described under the No Action Alternative.

III.C.5. Summary of Socioeconomic Impacts

In comparing the negative first round regional economic impacts on the NIA sector and the positive first round regional economic impacts on the Indian sector, it is important to keep in mind that these impacts would fall on different communities. Changes in first round economic impacts would affect different sectors of the population, but subsequent round regional impacts would affect the same sector primarily. Thus, even though the positive impacts would offset the negative impacts from an economic perspective, non-Indian farmers would bear the costs of declining agriculture under all alternatives. The analyses predict very little difference among alternatives in terms of NIA land going out of production and negatively impacting the Pinal County tax base. The reductions in acreage occur in the latter time periods. The county tax base is rooted in property taxes. Additional land fallowing is not expected to affect appraisal values of agricultural lands. Thus, no change is expected in county tax revenues. Any decreases in the agricultural tax base would probably be more than offset by increases from the M&I tax base, as the Pinal County economy continues to grow and diversify over the 50-year study period.

Agriculture has been the basis of economic growth in Pinal County. Families moved into Pinal County, developed farmland and formed communities. Businesses were created to provide goods and services to the farmers. Some families have farmed over multiple generations, non-Indian and Indians alike. According to the Census of Agriculture, the age of farmers is increasing. Many farmers have other jobs in addition to farming. There are many factors affecting the Pinal County agricultural way of life. The economy and social fabric are changing and diversifying.

The total regional economic impacts (covering all rounds of repercussions including the first round impacts) resulting from changes in NIA and Indian agriculture are shown in Tables III-6 through III-8. The tables present total regional economic impacts in terms of output, employment, and income. These total regional economic impacts incorporate the decreases associated with NIA and the increases associated with Indian agriculture.

The total economic impact on the three-County area caused by declines in NIA and increases in

Indian agriculture is smallest in the early years under all the alternatives and negative under the Settlement Alternative in 2004. The largest impacts occur in the later years.

Table III-6
CAP Allocation Draft EIS
Total* Economic Impact on Three-County Area
INDIAN AND NIA
Millions of dollars worth of changes in output (2000 dollars)

	Settlement Alternative	Non-Settlement Alternative 1	Non-Settlement Alternative 2	Non-Settlement Alternative 3A	Non-Settlement Alternative 3B
2001	$0	$0	$0	$0	$0
2004	-$3.8	$0	$0	$0	$0
2017	-$4.8	$0.6	-$2.6	-$2.6	-$2.6
2030	$33.2	$5.2	$15.0	$58.8	$49.4
2043	$33.2	-$0.3	$12.8	$58.8	$58.8
2050	$39.0	$13.2	$26.3	$72.3	$72.3

*Total impact includes first and subsequent rounds of regional economic impacts.
Source: Data was generated by the IMPLAN model, as described in Appendix D.

Table III-7
CAP Allocation Draft EIS
Total* Economic Impact on Three-County Area
INDIAN AND NIA
Employment: jobs

	Settlement Alternative	Non-Settlement Alternative 1	Non-Settlement Alternative 2	Non-Settlement Alternative 3A	Non-Settlement Alternative 3B
2001	0	0	0	0	0
2004	-124	0	0	0	0
2017	-80	62	-43	-43	-43
2030	221	-21	20	518	362
2043	221	-199	-17	519	519
2050	519	165	347	883	883

*Total impact includes first and subsequent rounds of regional economic impacts.
Source: Data was generated by the IMPLAN model, as described in Appendix D.

Table III-8
CAP Allocation Draft EIS
Total* Economic Impact on Three-County Area
INDIAN AND NIA
Millions of dollars of changes in income (2000 dollars)

	Settlement Alternative	Non-Settlement Alternative 1	Non-Settlement Alternative 2	Non-Settlement Alternative 3A	Non-Settlement Alternative 3B
2001	$0	$0	$0	$0	$0
2004	-$2.6	$0	$0	$0	$0
2017	-$2.9	$0.6	-$1.6	-$1.6	-$1.6
2030	$19.4	$2.9	$8.5	$34.7	$29.1
2043	$19.4	-$0.8	$7.1	$34.7	$34.7
2050	$24.1	$8.0	$15.9	$43.5	$43.5

*Total impact includes first and subsequent rounds of regional economic impacts.
Source: Data was generated by the IMPLAN model, as described in Appendix D.

III.D. LAND USE

III.D.1. Introduction

This section describes both the existing land uses that could be affected by the proposed allocation, and the anticipated land use changes that would occur as a result of alternative CAP water allocations and contract execution. Land use changes that are expected to occur in the absence of any additional CAP water allocations and subsequent contract execution are also described.

III.D.2. Impact Analysis Methodology

III.D.2.a. M&I Sector

The analysis regarding land use changes within the M&I sector focused primarily on projecting future population growth during the 50-year study period (2001 through 2051) and on identifying the likely areas within each M&I entity's municipal planning area (MPA) and / or service area that would likely be developed to accommodate this growth. The development would occur through the conversion of acres from agriculture and desert to urban. In most cases, the MPA of an entity is larger than the entity's existing water service area. Figures illustrating the MPA and / or service area of each of the affected 21 M&I entities are included in Appendix L.

Population projections for each entity over the study period were based upon ADES 1997 population projections for 2000 through 2050. Appendix C contains additional information on how the population projections were prepared. Population projections for each of the 21 entities are also included in Appendix L. The population projections were used to derive changes in population, the number of households and the corresponding reductions of acres of agricultural and desert lands. As mentioned earlier, these projections were developed by ADES independent of water supply availability.

The base for existing land use data for those M&I entities located in Maricopa County was the 1995 land use data obtained from Maricopa Association of Governments (MAG). The MAG land use categories include agriculture, developed, rural, vacant, and water. The “developed category” is comprised of a number of individual land use categories including various residential, commercial, industrial, and open space categories. For the purpose of converting the 1995 MAG data to current and future anticipated land usage, three land use categories were developed. The categories include agriculture, desert and urban. The agriculture category is the same as the 1995 MAG category. The desert category includes that area defined as vacant in the 1995 MAG data. The category of urban includes the 1995 MAG categories of developed, rural and water. In addition to redefining the land use categories, the 1995 data were then updated and adjusted based upon review of 1998 aerial photographs and the result of the field surveys and habitat mapping that were completed to assess biological resources for the entities (see Appendix L). Land use data for the other counties were based upon the review of 1998 aerial photographs and the result of the field surveys and habitat mapping.

The land use data and population projections were then used to calculate the number of acres of agriculture and desert lands that are anticipated to be urbanized for each of the M&I entities over the 50-year study. All of the M&I entities proposed to receive an allocation are located in Maricopa, Pinal, and Pima Counties. For the Maricopa County entities, the MPA and / or service area boundaries were more finely defined into Regional Analysis Zones (RAZ). For the Pinal and Pima County entities, the MPA and / or service areas were more finely defined into County Census Divisions (CCDs). The RAZ and CCDs are smaller geographic areas within an MPA designated for the purpose of estimating and projecting populations. The following methodology was used to translate population projections for MPAs, RAZs, and CCDs into reductions in acres of farmland and natural desert by entity for the 50-year study period.

Each MPA, RAZ, and CCD was evaluated to determine what proportion of the projected population change would result in declines in agricultural and desert acreage. Aerial photographs and maps showing agricultural areas were reviewed to determine what proportion of the projected population change would result in declines in agricultural and desert acreage. Certain RAZs inside of MPA boundaries have already been built out and developed and were therefore removed from the analysis. Population growth in parts of Maricopa County that lie outside of the region of analysis was excluded from consideration. Also certain CCDs were removed from the analysis, if it was determined the population change would not affect agriculture acreages. The following steps were then taken:

- Determine from MPA, RAZ, and CCD boundaries, the proportion of a projected population change that would result in the reduction of farm acreage and natural desert. Allocate the proportions to the respective MPAs, and RAZs or CCDs.

- Determine the number of persons per household for each MPA. For Maricopa County, this was estimated using the published MAG projections. Using the 1997 MAG maps and projections, estimate the number of households per acre in each of the MPAs. Approximations of households per acre are used to determine absorption of farmland and natural desert. This was estimated by using the 1990 Census for Pinal County and 1990 Census Atlas for Pima County. For example, in Pinal County, an approximation of two households per acre is used to determine the absorption of agricultural land inside city boundaries and of one house per acre outside the city boundaries. The approximations of households per acre were then used to determine absorption of agricultural lands and natural desert.

- Given the allocations of a projected population to reduction in farm and natural desert acreage determined above, allocate that proportion of the population change in each RAZ and CCD to the appropriate M&I entity.

- Divide the projected population increase for a given area by the persons per acre (this number includes the person per household number built in) to yield the number of acres that may displace agriculture or desert lands.

- Add the acreage reductions to each of the groundwater basins to derive the total reduction in agricultural and desert acres by entity for the 50-year study period, to obtain a total for the M&I sector.

The results of this analysis are displayed later in this section, in Table III-12.

The methodology relies primarily on the 1997 MAG Socioeconomic Projections Interim Report and on population projections for Maricopa County published by the ADES Population Statistics Unit on August 1, 1997. The MAG and ADES population projections have been reviewed and approved by the Central Arizona Council of Governments and the State Population Technical Advisory Committee and signed by the ADES Director.

The number of persons per household is derived from the MAG 1997 publication. The number of households per acre was derived for each MPA from MAG maps and the 1997 publication from representative RAZs. The allocation of population between agriculture and non-agriculture acreage is based on maps showing irrigated acreage in Maricopa County. The allocation of reductions in agricultural and desert acreage to respective groundwater basins is based on the relation of the groundwater basin boundary lines on the maps displaying groundwater areas to census area boundaries.

An analysis was conducted of each entity's projected water demands (based on population projections and water use rates) and the supplies available to meet those demands. In all alternatives, including No Action, it was determined the M&I entities' demands could be met with alternative supplies that could be developed, with or without the proposed CAP allocation. Appendix C contains a more detailed discussion of M&I demands and supplies.

III.D.2.b. NIA Sector

The abandonment of farming in the NIA sector would be the primary land use change associated with the proposed allocations. This land use change is anticipated to occur over time due to increasing unavailability of CAP water, and the increased cost of groundwater supplies. The analysis methodology employed to assess these impacts to the NIA sector included estimating the number of acres that would go out of agricultural production as a result of increasing unavailability of CAP water to the NIA sector. This analysis methodology is described in more detail above in the socioeconomic resources section and also in Appendix D.

III.D.2.c. Indian Sector

The rehabilitation of existing, retired or fallowed farm lands, the development of new agricultural lands, and construction of distribution systems that would occur in the Indian sector would be the major land use changes resulting from the proposed allocations. For purposes of this draft EIS it was assumed that funds would be available to develop the infrastructure that is necessary to take and use CAP water for agriculture. As shown in Appendix A, it was also assumed that the delivery systems would be completed and functioning by the year 2040. This assumption was made to ensure impacts from using the allocated water would be evident and taken into account in the analysis. To provide a "worst" case analysis, the draft EIS assumes all agricultural development resulting from receipt of CAP water through any of the proposed allocation alternatives would be new development occurring on desert land.

III.D.3. Affected Environment

III.D.3.a. General Land Use

As noted in Chapter I, the majority of the lands that would be affected by the proposed allocation are located within the three-county area that includes Maricopa, Pinal and Pima Counties. All 21 M&I entities and 9 NIA users, and two (GRIC and TON) of the five Indian Tribes potentially affected by the proposed allocation fall within this geographical three-county area. Additional areas within Gila and Graham Counties (associated with SC Apache Tribe) and within Coconino and Navajo Counties (associated with Navajo / Hopi) would also be affected under Non-Settlement Alternative 2 or 3.

The primary land ownership for Maricopa, Pinal and Pima Counties is shown in Tables III-9, III-10 and III-11, respectively.

Table III-9
CAP Allocation Draft EIS
Land Ownership – Maricopa County

Ownership	Percent
Private Land	29
Public Lands: BLM / U.S. Forest Service	39
Public Lands – State	11
Public Lands – Other	16
Tribal Lands	5
Total	100

Source: Arizona Department of Commerce, 1999
1998 County population: 2,800,000 (MAG 1999)
Total County area = 9,222 square miles (mi^2).

Table III-10
CAP Allocation Draft EIS
Land Ownership –Pinal County

Ownership	Percent
25.7	
Public Lands: BLM / U.S. Forest Service	17.5
Public Lands – State	35.3
Public Lands – Other	1.2
Tribal Lands	20.3
Total	100

Source: Arizona Department of Commerce, 1999a
1998 County population: 157,675
(Arizona Department of Commerce, 1999c)
Total County area = 5,371 mi^2.

Table III-11
CAP Allocation Draft EIS
Land Ownership – Pima County

Ownership	Percent
Private Land	13.8
Public Lands: BLM / U.S. Forest Service	12.1
Public Lands – State	14.9
Public Lands – Other	17.1
Tribal Lands	42.1
Total	100

Source: Arizona Department of Commerce, 1999b
1998 County population: 824,900
(Arizona Department of Commerce, 1999c)
Total County area = 9,184 mi^2

As described earlier in this section, the areas potentially affected by the proposed allocations would include agricultural, developed, rural, urban, and vacant land, as well as some bodies of water. For purposes of this draft EIS, these land uses (which were based on 1995 land use data) were then converted into the categories of agriculture, desert and urban. Tables identifying the current land use designations for each of the individual M&I, NIA and Indian users which would receive an allocation under any of the proposed alternatives are included in Appendix L.

III.D.3.b. M&I Land Use

The 21 M&I entities proposed to receive a CAP allocation in three of the action alternatives have a combined planning area of approximately 2.1 million acres. Of this total, approximately 954,000 acres (or 45 percent) are currently developed, approximately 100,000 acres (or five percent) are farmed, and approximately 1.2 million acres (or 55 percent) are desert.

III.D.3.c. Agricultural Land Use

In 1997, there were an estimated 26,866,722 acres of land in farms in the State of Arizona. Overall, the acres of land in farms in Arizona decreased by approximately 23 percent between 1992 and 1997. The average size of farms in the State decreased by approximately 15 percent and the number of full-time farms decreased by approximately 10 percent statewide during the same time period.

III.D.3.d. Indian Land Use

III.D.3.d.(1) GRIC

The GRIC is located south of the Phoenix metropolitan area and encompasses 372,929 acres, of which 275, 537 acres are Tribal lands and 97,392 acres are allotted lands[44]. Reservation land use is

[44] The General Allotment Act of 1887, as amended, established the allotment system on reservations. Once executed, between 1916 and 1924, each Tribal member was allotted a certain number of acres. Today, due to inheritance, individual allotments are owned by anywhere from one to several dozen people. Land not allotted to individuals within a reservation are Tribally owned and managed.

predominantly rural with interspersed pockets of commercial, industrial and residential developments. The area within GRIC with the highest potential for commercial/industrial development is along the northern boundary, from Old Price Road to 51st Avenue, and along the Queen Creek and Riggs Roads alignments. There are approximately 294,000 acres of open rangelands used for grazing livestock. Livestock grazing units are primarily located along the Gila and Santa Cruz rivers, their tributaries and in upland areas. There are approximately 69,300 acres that have been historically developed for agricultural production within GRIC (Reclamation 1997); the number of acres actually farmed from year to year depends upon water availability.

III.D.3.d.(2) TON

The TON is located in southern central Arizona extending down to Mexico. It is composed of four non-contiguous segments totaling more than 2.8 million areas, which are divided into 11 political districts. The main body of the reservation contains nine of those districts, and is approximately 4,330 square miles in size. The Schuk Toak District is located along the eastern portion of this main body. The San Xavier District is geographically separate from the main body of the reservation. It encompasses 71,095 acres, and is comprised of approximately 28,800 acres of Tribal land and 42,295 acres of allotted land. The predominant land use on the areas of both districts that would be affected by the project is cattle grazing, with much of the other areas consisting of open space. Copper mining also occurs on San Xavier District lands leased to ASARCO. This lease encompasses approximately 2,554 acres along the southern San Xavier District boundary between Mission Road and I-19. Approximately 1,100 acres have historically been farmed on the San Xavier District. About 400 acres are currently under production (Reclamation 1999).

III.D.3.d.(3) SC Apache Tribe

The SC Apache Tribe, in southeastern Arizona, is located within Gila, Graham and Pinal counties, Arizona. It encompasses 1,834,781 acres, ranging from highland desert in the southernmost part of the reservation, to mountainous areas interspersed with grassland prairies in the central area, and abundant stands of ponderosa pine, blue spruce and aspen in the northern portion of the reservation. Over one-third of the reservation land consists of forested (175,000 acres) or wooded(665,000 acres) lands[45]. San Carlos Reservoir, formed by Coolidge Dam, is more than 16,600 surface acres at top of conservation (about 880,00 af). Primary land uses on the reservation include grazing, recreation (mostly water based), agriculture, mining and timber. Historically up to 3,000 acres were farmed; over the last three decades, SC Apache Tribe has irrigated an average of over 500 acres annually (ADWR 1999). These areas are generally located along the Gila River near Bylas, adjacent to the San Carlos River and along other major tributaries to the San Carlos River.

III.D.3.d.(4) Hopi Tribe

The Hopi Tribe's reservation is located in northeastern Arizona within Navajo and Coconino counties, Arizona. It encompasses over 1.5 million acres. Reservation lands are primarily high deserts dominated by three mesas ranging in elevation from 5,000 to 6,500 feet. Relatively dense populations and a cultural center are located on these three natural features, with most of the 34 clans living in

[45] Intertribal Council website: ww.primenet.com/~itca/Tribes/sancarl.htm

12 villages on or near these mesas. The land is suitable for grazing with the potential for expanded agricultural development. The Hopi people have practiced agriculture for hundreds of years despite an arid landscape and an average of only 12 inches of rainfall a year.

III.D.3.d.(5) Navajo Nation

The Navajo Nation's reservation is the largest Indian reservation in the United States. It encompasses an area approximately 27,000 square miles, and falls within portions of Arizona, New Mexico and Utah. The Navajo Nation is divided into 110 chapters, which are areas of local government. The major existing land uses include livestock grazing, agriculture, mining, and oil and gas production. The Navajo Nation has the potential to expand many of these uses, including agricultural development. Vast expanses of open space exist within the reservation.

III.D.3.e. Prime Farmland

In 1997, the State of Arizona had approximately 876,600 acres of prime farmland. Some of this prime farmland exists in the area affected by the proposed allocation (NRCS 1997). The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) defines prime farmland as land that has the best combination of physical and chemical characteristics for producing food, seed, forage, fiber and oilseed crops, which is also available for these uses. It has the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods. In general, prime farmland has an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt or sodium content, and no rocks (NRCS Acres of Prime Agriculture 1997).

Currently, the NRCS has completed soil surveys for numerous areas in the State. Portions--but not the entire--area affected by the proposed allocations have been surveyed. In general, the Soils Surveys published by NRCS include a description of soil types, their suitability, limitations and management for specified used. As part of the soil classification, the surveys also indicate which soil types would be considered prime. Detailed maps indicating the soil classification and the area surveyed are also included.

III.D.4. Environmental Consequences

A summary of the land use impacts anticipated to occur by alternative, is provided in Table III-12.

Table III-12
CAP Allocation Draft EIS
Land Use Changes 2001 – 2051

	No Action	Settlement Alternative	Non-Settlement Alternative 1	Non-Settlement Alternative 2	Non-Settlement Alternative 3A	Non-Settlement Alternative 3B
Agriculture Acres Urbanized - M&I*	68,150	68,150	68,150	68,150	68,150	68,150
Desert Acres Urbanized - M&I *	240,000	240,000	240,000	240,000	240,000	240,000
Agriculture Acres Urbanized Within NIA Districts**	46,900	46,900	46,900	46,900	46,900	46,900
Agriculture Acres Left Fallowed Within the NIA Districts**	40,926	40,926	40,926	40,926	40,926	40,926
Desert Acres Developed for Agriculture	na	24,800	8,000	25,400	50,000	50,000

* Includes the MPA and / or service area for each of the 21-M&I entities
**Some of the acreage in the above categories are overlapping. For the acres per entity, see Appendix L

III.D.4.a. Prime Farmland

As urbanization increases, which would occur under all alternatives, including that of no action, prime farmland located adjacent to urban areas would be developed. Actively irrigated prime farmland within NIA districts could also be fallowed as a result of economic conditions under all alternatives; however, the rate at which lands would be fallowed varies depending upon the alternative. Because new lands would be developed and retired / fallowed farmlands would be rehabilitated for agriculture on Indian lands, there could be additional lands classified as prime farmland brought into production as well. The amount of net acreage of prime farmland adversely affected by any of the alternatives cannot be estimated.

III.D.4.b. M&I Sector

III.D.4.b.(1) No Action Alternative

Under the No Action Alternative, it is estimated that approximately 308,150 acres would become urbanized within the 21 M&I MPAs and / or service area. Table III-12 provides both the total number of agricultural acres urbanized and the total number of desert acres urbanized for this alternative.

III.D.4.b.(2) Settlement and Non-Settlement Alternatives

Under all action alternatives, the number of acres that would become urbanized within the M&I MPA's and/or service areas would be the same as under the No Action Alternative. As explained in detail in Appendix C, an analysis of the estimated water supplies and water demands for each M&I entity through the study period indicates sufficient water supplies would be available to meet projected water demands for the 50-year study period. Therefore, it is assumed the degree of urbanization that would occur under the No Action Alternative would also occur under any of the action alternatives.

III.D.4.c. NIA Sector

III.D.4.c.(1) No Action

Under the No Action Alternative, it is estimated that approximately 46,900 acres of agricultural land would become urbanized and 40,926 acres of agricultural land would be fallowed as a result of economic conditions. Table III-12 provides both the total number of agricultural acres urbanized and the total number of acres fallowed within the NIA sector. The total average urbanized is the same for all alternative as it was determined that M&I entities would meet their population projections under all alternatives (see Appendix C for more detail.) Although the total number of agricultural acres left follow within the NIA sector is the same for all alternatives, the timing of acres followed varies somewhat by alternative. Appendix D provides detail on acres fallowed by year by alternative.

III.D.4.c.(2) Settlement and Non-Settlement Alternatives

Under all alternatives, approximately 46,900 acres of farmland would be urbanized and 40,926 acres would be fallowed due to economic reasons. While the totals would be the same, the timing of the 40,926 acres being fallowed varies by alternative. Details are provided in Appendix D.

III.D.4.d. Indian Sector

Under the No Action Alternative, there would be an increase in the number in agricultural lands in Indian communities that would result from existing CAP water allocations being utilized for irrigation. Table III-12.

III.D.4.d.(1) GRIC

III.D.4.d.(1)(a) No Action

Under the No Action Alternative, it is anticipated GRIC would continue developing and farming up to 86,000 acres. For purposes of this draft EIS, it is assumed the acres developed would consist of a mix of existing and/or previously farmed acres that are rehabilitated, and native desert that are developed; however, it is unknown what the exact ratio would be of these 86,000 acres.

III.D.4.d.(1)(b) Settlement and Non-Settlement Alternatives

Under the action alternatives, it is anticipated GRIC would rehabilitate or develop additional acreage for agricultural production as a result of receiving varying amounts of additional CAP water as follows:

Table III-13
CAP Allocation Draft EIS
Agricultural Acreage Developed by GRIC under Action Alternatives

GRIC	No Action	Settlement	NSA 1	NSA 2	NSA 3
Incremental increase	---	+20,800	+8,000	+16,700	+38,000
Total acres developed	86,000	106,800	94,000	102,700	124,000

For purposes of analyzing impacts in this draft EIS, it is assumed development of these additional acres would all occur on areas that are currently native desert (although some of the acreage could actually be rehabilitated existing or retired agricultural lands). This change in land use was previously described and evaluated in the GRIC PMIP Programmatic EIS (PEIS) (Reclamation 1997). Briefly, the PEIS identified development of up to 77,000 new acres and rehabilitation of about 69,330 acres of previous or existing agricultural lands. There could be up to 35 percent reduction in the amount of existing rangeland. The PEIS indicates additional studies would be conducted during phased implementation of the PMIP, to identify the number of cattle and wild horses that would be affected as alignments and locations of facilities are finalized. The PEIS also indicated GRIC's intent to develop a process to evaluate future residential subdivision development versus potential agricultural areas to buffer concentrated residential development from agricultural activities. Other environmental documentation would address potential conflicts and site-specific mitigation measures for any future agricultural development proposed for areas in close proximity to existing residential areas (Reclamation 1997). No other substantive conflicts with existing land uses within the GRIC reservation were identified in the PEIS.

III.D.4.d.(2) TON

III.D.4.d.(2)(a) No Action Alternative

The San Xavier District is in the process of constructing a CAP Link pipeline to facilitate delivery and use of the District's existing CAP water allocation. If all 27,000 afa of San Xavier District's current CAP allocation were used for agriculture, approximately 5,400 acres could be developed and farmed. There are sufficient number of farmable acres located within the district to accommodate this additional agricultural development.

The Schuk Toak District is currently constructing facilities to take and use its existing CAP water allocation of 10,800 afa. The District is in the process of developing land within the southeastern portion of what is commonly referred to as the "Garcia Strip," where this water will be used to irrigate up to 2,580 acres. This area was formerly native desert used for grazing (Franzoy Corey 1988).

In the absence of identifying a source for the remaining 28,200 afa of water suitable for agriculture, which was authorized by SAWRSA, the United States would continue to have the responsibility of identifying a source and providing this water for the Districts' use.

III.D.4.d.(2)(b) Settlement and Non- Settlement Alternatives

Under the Settlement Alternative, Non-Settlement Alternative 2 and Non-Settlement Alternative 3, CAP water would be identified and allocated as the source of the additional 23,000 afa of water (suitable for agriculture) authorized by SAWRSA to be delivered to the San Xavier District. For purposes of this impact analysis, it was assumed that 15,000 afa would be used for irrigation and an additional estimated 3,000 acres would be developed for agriculture. The remaining 8,000 afa would be used for recharge, either through a direct or indirect recharge project. Assuming a direct recharge project is constructed (which would disturb the greatest amount of land), this would affect up to an additional 70 acres. It is anticipated the additional 3,070 acres that could be affected as a result of the proposed allocation would be located in areas that are currently undisturbed desert. The San Xavier District would receive no CAP water allocation under Non-Settlement Alternative 1; impacts would be as described for the No Action Alternative.

Under the Settlement Alternative, Non-Settlement Alternative 2 and Non-Settlement Alternative 3, CAP water would be identified and allocated as the source of the additional 5,200 af of water (suitable for agriculture) authorized by SAWRSA to be delivered to the Schuk Toak District. For purposes of this impact analysis, it was assumed that the entire amount would be used to develop up to an additional 1,000 acres for agriculture. The original design for the recently constructed CAP delivery system included consideration of future development utilizing the District's entire 16,000 afa entitlement under SAWRSA to develop a total of 3,700 acres. The land (1,000 to 3,700 acres depending upon which estimate is used) that would be developed with this additional 5,200 afa was identified as those lands lying directly north of the existing development (Franzoy Corey 1988). These lands consist of native desert that has been used for grazing. The Schuk Toak District would receive no CAP water allocation under Non-Settlement Alternative 1; impacts would be as described for the No Action Alternative.

III.D.4.d.(3) SC Apache Tribe

III.D.4.d.(3)(a) No Action Alternative

Under the No Action Alternative, it is anticipated SC Apache Tribe would continue to expand its current farming efforts to eventually develop 7,300 acres of agricultural land, utilizing its existing CAP water allocation. The 7,300 acres would likely be developed along the Gila and San Carlos Rivers, as they are closest to San Carlos Reservoir, the likely point of diversion.

III.D.4.d.(3)(b) Settlement and Non-Settlement Alternatives

SC Apache Tribe would receive an allocation for additional CAP water under Non-Settlement Alternative 2 (23,447 afa) and Non-Settlement Alternative 3 (40,000 afa). For purposes of the draft EIS analysis, it is assumed the water would be used to develop additional agricultural lands, resulting in an additional 4,700 acres farmed under Non-Settlement Alternative 2 and an additional 8,000 acres being developed under Non-Settlement Alternative 3. It is anticipated lands that would be targeted for development would be located along the Gila and San Carlos Rivers, and tributaries of the San

Carlos River. Additional evaluation would need to be conducted to determine what specific land use conflicts could exist, once lands targeted for agricultural production are identified.

III.D.4.d(4) Navajo Nation and Hopi Tribe

III.D.4.d.(4)(a) No Action Alternative

Neither the Navajo Nation nor the Hopi Tribe has an existing CAP water allocation. No CAP water would be allocated to either Tribe under the No Action Alternative; no change from current land use trends would be anticipated to occur.

III.D.4.d.(4)(b) Settlement and Non-Settlement Alternatives

Together the Navajo Nation and Hopi Tribe would receive an allocation of CAP water of 13,500 afa under Non-Settlement Alternative 2 and Non-Settlement Alternative 3. This water would be used for M&I purposes, most likely in conjunction with or complementary to water uses that are being considered as part of other ongoing settlement negotiations. These include providing a reliable potable water supply for areas within the Lower Colorado River basin that are currently without one, and providing a renewable surface water source for use by Peabody Western Coal Company's Black Mesa Mine coal slurryline operation[46], thus reducing the amount of groundwater being pumped (about 4,000 afa). These uses would be consistent with current land uses and are not anticipated to conflict with future land use trends. Under the Settlement Alternative and Non-Settlement Alternative 1, the Navajo Nation and the Hopi Tribe would not receive a CAP water allocation; impacts would be as described under the No Action Alternative.

[46] The mine and slurry operations are currently served by groundwater pumping under an agreement with the Hopi Tribe. If Peabody Western Coal Company elects to participate in the proposed Lake Powell Pipeline Project, it is envisioned approximately 4,000 afa would be used by the slurryline operation for the remainder of the life of Black Mesa Mine, estimated to close around the year 2032. After the mine closes, the water would shift to M&I use.

III.E. BIOLOGICAL RESOURCES

III.E.1. Introduction

The study area for the proposed allocations is located primarily in central Arizona from north of Phoenix to south of Tucson. This area includes several ecological communities, but most of this region is within the Sonoran Desertscrub Biome (Brown 1982). Outside this region, the Tribal entities of Navajo/Hopi and San Carlos Apache occupy higher elevation plant communities such as semidesert grassland, pinyon-juniper woodlands and ponderosa pine conifer forests or are within the Great Basin Desertscrub Biome.

Biological resources would be impacted by the water allocations in two ways. First, varying amounts of new agricultural lands would be developed on Indian reservations with a resulting loss of wildlife habitat. Other uses of CAP water on the reservations are also possible (see Appendix L). Second, and less important from a biological perspective, varying amounts of NIA farmland would be fallowed under the different alternatives. Urban growth is expected to continue under all alternatives, including the No Action Alternative, with resulting conversions of native desert and agricultural lands to urban uses. Even though the draft EIS analysis concludes that the allocation of CAP water would not have an effect on urban growth (See Appendix C), the biological resources impacted by urban growth are described as part of the environmental consequences under the No Action Alternative. Details on the biological resources for each water user's planning area are contained in Appendix L.

III.E.2. Methodology

Habitat type was assessed for over 1,600 square miles (over one million acres) within the M&I MPAs and/or water service areas. Areas were field surveyed at the rate of 50 square miles per day during December 1999 and January 2000.

To aid in the determination of association types, and to ascertain an estimate of important ecological parameters, a total of 169 sampling sites were established in what appeared to be habitat typical for each specific area. At each sampling site, an initial point was identified by randomly obtained compass bearings and distance units. The number of samples taken was in direct relationship to the size of the total area to be sampled. To estimate foliar height density ([fhd]= horizontal and vertical density of vegetation), live plant material was identified and marked as present or absent within an imaginary vertical cylinder one decimeter in diameter at height intervals of 0-1.5 meter (m), 1.5-1m, 1-2m, 2-3m, 3-4m, and >4m. Secondly, all perennial species were identified within a radius of 3m, and then the distance (up to 500m) to the nearest tree (> 6 inches diameter breast height [dbh]) was estimated for each of four quadrants. Finally, any additional perennial species visible in the area were recorded. Saguaro density was calculated and ranked into the following categories: 1) None = none in sight of plot, 2) low = one saguaro per 50 acres or more, 3) moderate = one saguaro per 10-50 acres, and 4) High = one saguaro per 10 acres or less. The data were averaged within each sampling unit of each Planning Entity and a determination was done to establish which biotic association each site belonged.

Habitats were typed at broad association levels as described by Brown (1982) and, with the aid of aerial photographic enlargements (1 inch = 1,200 feet) or with comparable contact prints, were delimited onto clear acetate overlays. Because of the broad area covered, closely-related associations were not distinguished. Where possible, vegetation polygons were mapped to an accuracy of approximately 40 acres. In some areas, lines were drawn using best judgment where associations intergraded imperceptibly.

The USFWS has issued specific guidance that can be used to identify potentially suitable habitat for the endangered cactus ferruginous pygmy-owl (64 FR 14999-15000). Suitable habitat for the pygmy-owl is defined as areas below 4,000 feet in elevation containing one or more of the following vegetation communities:

- **Riparian vegetation**: Broadleaf, riparian gallery forests of cottonwoods, willows, mesquite, ash, or other tress growing along watercourses and associated species.

- **Sonoran desertscrub**: Characterized by braided wash systems and vegetation which is dense and well structured. Key species include mesquite, foothill and blue paloverdes, ironwood, saguaro, organ pipe cactus, and various other shrubs and cacti.

- **Semidesert grasslands**: Containing wooded drainage with mesquite, hackberry, ash, and limited number of saguaros.

Vegetative communities listed above, containing saguaro cactus or other columnar cactus that are eight feet or taller, or ironwood, mesquites, paloverde or other large trees with a trunk diameter of six inches or greater measured 4.5 feet above the ground may provide nesting opportunities for pygmy-owls.

In addition, the Bureau of Land Management (BLM) (1999 Krueper, D. Pers.com) provided criteria for assessing the suitability of habitat for pygmy-owls. Both criteria were utilized to identify potentially suitable habitat for the cactus ferruginous pygmy-owl within each planning area.

Habitat descriptions for each listed T&E species were obtained from the FR, the USFWS T&E species county lists, and other applicable published literature sources. By integrating this information with the vegetational data, potentially suitable habitat for the listed species were delineated on aerial photographs within each MPA.

III.E.3. Affected Environment

III.E.3.a. Vegetation Associations

Eight habitat types were identified using the Brown (1982) classification system. Scientific names for plant species identified below are provided in Appendix E, Table 3.

- **Blue Paloverde/Desert Ironwood Association** - When found along washes and drainages, the xeroriparian habitat created by this association can provide valuable wildlife habitat. Co-dominants in the survey area include foothill paloverde, desert-willow, desert-broom, ragweed, graythorn, white-thorn acacia, velvet mesquite, and catclaw acacia.

- **Bursage/Foothill Paloverde Association -** Bursage, which averages under 1.5 feet in height, is generally the most common element of this association. Creosote bush, which averages between three & five feet, is also very common and, of course, the most frequent tree is the foothill paloverde. Saguaros are nearly always present and sometimes densely distributed. Drainages are often densely vegetated with blue paloverde and desert ironwood and technically belong to their collective association but are generally too narrow to map within the resolution of this assessment. The study did not distinguish between the Bursage-Saguaro-Mixed Scrub and Brittlebush-Mixed Shrub Associations.

- **Creosote-Bush Association -** Although often composed of nearly pure stands of creosote-bush, this association can grade toward Bursage-Foothill Paloverde, Velvet Mesquite, and Snakeweed/ Velvet Mesquite Associations. Creosote-Bush Association is usually found in flat terrain at lower elevations. Larger drainages are often vegetated with stands of Blue Paloverde/Desert Ironwood Association. However, most are not within the mapping resolution of the present assessment. In general, this association has lower wildlife values than other associations identified in this draft EIS.

- **Creosote-Bush/Allthorn Association -** This association is mostly found on light textured soils, such as those high in gypsum or calcium. Several rare plant endemics, such as the Apache wild-buckwheat, Arizona cliffrose, Mearn sage, Arizona wild-buckwheat, and Ripley wild-buckwheat occur on white, chalky soils within this community. Of these, only the Arizona wild-buckwheat has been found within the study area. Co-dominants within the study area include staghorn cholla and little-leaved krameria. Other common species include tiquilia, foothill paloverde, ocotillo, jojoba, catclaw acacia, snakeweed, ephedra, bursage, fairy-duster, California wild-buckwheat, saguaro, fluffgrass, brittlebush, and hedgehog cactus.

- **Fremont Cottonwood/Goodding Willow Association -** Cottonwood and willow forests are largely restricted to the immediate flood plains of perennial streams and rivers. Depending on stand size and quality, these riparian habitats can support the highest plant and wildlife diversity within the study area. In the survey area, the third most common tree species within this community was saltcedar. Owing to the coarseness of the resolution, both Saltcedar Association and Saltcedar/Mixed Scrub Association are included here. Vegetation structure of the Fremont Cottonwood/ Goodding Willow Association is variable. As many strands and patches of this community were not within the study's resolution, they often are not indicated on the vegetation maps.

- **Jojoba/Mixed Scrub Association -** This is an association of generally east- to north-facing steep and/or rocky slopes between 2,500-foot and 4,500-foot elevation. Although some areas are covered by nearly pure stands of jojoba, most contain numerous co-dominant shrubs such as California wild-buckwheat, turpentine-bush, fairy-duster, Pima ratany, and catclaw acacia.

- **Snakeweed/Velvet Mesquite Association -** This represents a disclimax desert grassland where perennial grasses have been nearly extirpated. The association is variable with respect to the relative composition of several species, including snakeweed, velvet mesquite, goldenweed, desert-broom, creosote-bush, and paperflower. Other related associations, such as the Goldweed/Mixed Scrub Association were included here. This association occurs on lower bajadas and plains southeast of Tucson.

- **Velvet Mesquite Association -** The Velvet Mesquite Association ranges from sparse to very dense, nearly homogenous stands. It is a community of low-lying areas where water runoff collects or passes intermittently, and is often associated with the banks of drainages or abandoned agricultural fields. Species commonly associated with this community are creosote bush, tamarisk, desert-broom, snakeweed, goldenweed, Fremont wolfberry, and whitethorn acacia.

III.E.3.b. Fish and Wildlife

No specific wildlife surveys were conducted. Birds, mammals, reptiles and amphibians that are typically associated with the Sonoran Desertscrub Biome are listed in Table 4, Appendix E. Only general wildlife observations were recorded during field surveys.

III.E.3.c. Colorado River Mainstem

Lake Powell and the first 15.5 miles of the Colorado River downstream of Glen Canyon Dam are part of the Glen Canyon National Recreation Area. The river flows another 278 miles through Grand Canyon National Park into Lake Mead, part of the Lake Mead National Recreation Area. All of these areas are administered by the National Park Service (Reclamation 1995). Other lands adjacent to the river or National Park Service lands are administered by the Forest Service, Hualapai Tribe, Navajo Nation, and the Havasupai Tribe.

Between Glen Canyon Dam and Lake Mead, the Colorado River falls about 1,900 feet, or from approximately 3100 to 1200 feet above sea level. Major tributaries in this reach of the Colorado River mainstem include the Paria and Little Colorado Rivers , and Bright Angel, Kanab, Havasu, and Diamond creeks.

Prior to the completion of Glen Canyon Dam in 1963, flows in the Colorado River were characterized by large year to year and seasonal variability. Melting of mountain snowpack typically produced high runoff of long duration during the late spring and early summer. Annual maximum flows greater than 80,000 cfs were not uncommon. In late summer, fall, and winter, flows were typically below 3,000 cfs. Flow regulation by the dam has resulted in a slight increase in median flows and a large decrease in the magnitude and frequency of major floods in the Colorado River, although tributary floods continue to produce temporary uncontrolled peak flows in the river (Reclamation 1995).

Historically, the Colorado River and its tributaries were characterized by heavy sediment loads, variable water temperatures, large seasonal flow fluctuations, extreme turbulence, and a wide range of dissolved solids concentrations (Reclamation 1995). Water temperatures varied on a seasonal basis from highs around 80° Fahrenheit (F) to lows near freezing. Water released from Glen Canyon dam averages about 46°F year round. Lake Powell traps sediment that historically was transported downstream. The dam releases clear water and the river becomes muddy only when downstream tributaries contribute sediment.

Prior to the construction of Glen Canyon Dam, riparian vegetation developed only above a scour zone that was affected by the seasonally high river flows. This vegetation consisted mainly of acacia, mesquite, and hackberry. Following dam construction, protection from annual high flows allowed the riparian vegetation to develop below this scour zone. Today, this habitat is a mixture of native and non-native plant species that provides habitat for numerous species of mammals, birds, amphibians and reptiles, and terrestrial invertebrates.

Glen Canyon Dam stores and releases water from Lake Powell, which has an active capacity of about 24.3 maf. A collection of Federal and State statutes, interstate compacts, court decision and decrees, an international treaty with Mexico, and criteria and regulations set by the Secretary determine how Colorado River water will be operated, diverted, released, and delivered. These are collectively known as the "Law of the River."

More specific information on the natural resources before and after the construction of Glen Canyon Dam can be found in the Final Environmental Impact Statement (FEIS) on the operation of Glen Canyon Dam (Reclamation 1995).

The Federal endangered species that are found within this project area include the humpback chub (Gila cypha), razorback sucker (Xyrauchen texanus), bald eagle (Haliaeetus leucocephalus), southwestern willow flycatcher (Empidonax traillii extimus), and the Kanab ambersnail (Oxyloma haydeni kanabensis). In March 1994, the USFWS designated critical habitat for the chub and sucker. Critical habitat for the humpback chub includes the lower eight miles of the Lower Colorado River and the Colorado River from River Mile 34 to 208. For the razorback sucker, critical habitat includes the Colorado River from the confluence with the Paria River to and including Lake Mead. Both species are endemic to the Colorado River Basin. While the razorback can be found near areas with strong currents, it is typically associated with backwaters, side channels, flooded bottom lands and other slower moving habitats. The chub is typically associated with canyon areas with fast current, deep pools, and boulder habitat.

No critical habitat has been designated for the threatened bald eagle. The Colorado River corridor through the Grand Canyon is used by migrating bald eagles in the winter. They were not often observed in the Grand Canyon until after the rainbow trout fishery below Glen Canyon Dam was established (Reclamation 1995).

The Kanab ambersnail is a small terrestrial landsnail found in semiaqautic vegetation watered by springs or seeps at the base of sandstone or limestone cliffs (FWS 1998). One population is found within the Grand Canyon but no critical habitat has been designated.

Breeding southwestern willow flycatchers are found along the mainstem downstream of Glen Canyon Dam to the Lake Mead delta. Critical habitat is designated between the confluences of Bright Angel Creek and Tanner Creek.

III.E.3.d. Federally Listed Threatened and Endangered (T&E) Species

All M&I and NIA, and two of the Tribal entities are located within a three county area: Maricopa, Pinal, and Pima. A total of 24 T&E species have been recognized for these counties. After reviewing the literature on each species, and conducting habitat assessments within each county, the list of possible T&E species which might be affected by Tribal agricultural developments or urban growth within the 21 MPAs was reduced to 10 (Table III-14). These 10 species are briefly discussed below. The remaining Tribal entities are located in other counties and are discussed in more detail in Appendix L.

Table III-14
CAP Allocation Draft EIS
Federally listed T&E species which might occur within the study area.

Common Name	Scientific Name	Status	Maricopa	Pinal	Pima
Arizona agave	*Agave arizonica*	Endangered	P		
Arizona cliffrose	*Purshia subintegra*	Endangered	P		
Arizona hedgehog cactus	*Echinocereus triglochidiatus var.*	Endangered	P	P	
Bald eagle	*Haliaeetus leucocephalus*	Threatened	C P	P	
Cactus ferruginous pygmy	*Glaucidium brasilianum cactorum*	Endangered	P	P	C
Lesser long-nosed bat	*Leptonycteris curasoae yerbabuenae*	Endangered	P	P	
Nichol's Turk's head cactus	*Echinocereus horizonthalonius var.*	Endangered		P	
Pima pineapple cactus	*Coryphantha scheeri var. robustispina*	Endangered			
Southwestern willow	*Empidonax traillii extimus*	Endangered	P	P	
Yuma clapper rail	*Rallus longirostris yumanensis*	Endangered	P	P	
		Total	8	7	1

*C=Critical habitat has been designated.
P=Potential suitable habitat in the general area.

III.E.3.d.(1) Arizona Agave

The Arizona agave has rosettes of bright green leaves with dark reddish-brown margins. The flower is borne on a sub-umbellate inflorescence. This species is found in the transition zone between oak-juniper woodland and mountain mahogany-oak scrub habitat at an elevation range of 3,000-6,000 feet, usually on steep, rocky slopes. Scattered clones have been found in the New River and the Sierra Anches Mountains, and may possibly occur in the Mazatzal Mountains. Surveys should be conducted wherever the ranges of *Agave toumeyana var. bella* and *Agave chrystantha* overlap. Arizona agave may be found in Gila, Yavapai, and Maricopa Counties.

III.E.3.d.(2) Arizona Cliffrose

The Arizona cliffrose is an evergreen shrub of the rose family, with pale, shredded bark. The young twigs have dense hairs. Leaves have one to five lobes with down-curled edges. The flowers have five white or yellow petals less than 0.5 inches long. The Arizona cliffrose is found on white soils of tertiary limestone lakebed deposits at elevations below 4,000 feet. All four localities of this species are in Central Arizona below the Mogollon Rim. These known sites include Burro Creek drainage (Mohave County), Horseshoe Lake area (Maricopa County), Verde Valley (Yavapai County), and San Carlos Indian Reservation (Graham County).

III.E.3.d.(3) Arizona Hedgehog Cactus

The Arizona hedgehog cactus is dark green, cylindroid, 2.5-12 inches tall, two to ten inches diameter, has one to three gray or pinkish central spines and five to eleven shorter radial spines. They grow singly or in clusters and have brilliant red flowers on the side of the stem in April-May. Plants are found on open slopes, in narrow cracks between boulders and in the understory of shrubs in the ecotone between Madrean Evergreen Woodland and Interior Chaparral. Arizona hedgehog may be found at elevations from 3,700-5,200 feet in Gila and Pinal counties, in the Superior-Globe area.

III.E.3.d.(4) Bald Eagle

The bald eagle is a large raptor with a wingspan of 66-96 inches and a height of 28-38 inches. Adults have a white head, neck, and tail, while birds four years old or less are dark with mottled brown plumage. Eagles feed primarily on fish, but waterfowl, small mammals, and carrion constitute a portion of the diet. Arizona's resident population of bald eagles (40 known breeding territories) breeds mostly along the lower elevations of the Salt and Verde Rivers. Nesting sites are usually in trees, on cliffs or pinnacles in close proximity of water. A significant number of wintering eagles can be found at most elevations and habitat types near water, especially along the Mogollon Rim and the White Mountains. On July 6, 1999, the USFWS published a proposed rule to remove the bald eagle from the list of T&E wildlife in the lower 48 States (64 FR 36453-36464). Bald eagles may be found in Yuma, La Paz, Mohave, Yavapai, Maricopa, Pinal, Coconino, Navajo, Apache, Santa Cruz, Pima, Gila, and Graham Counties.

III.E.3.d.(5) Cactus Ferruginous Pygmy-Owl

The cactus ferruginous pygmy-owl is a small (approximately seven inches tall) owl having reddish-brown feathers overall with a cream-colored belly streaked with reddish-brown, although some individuals are grayish-brown. Diet includes birds, lizards, insects and small mammals. It is non-migratory throughout its range. The western population of the subspecies spans from lowland Central Arizona south through western Mexico. Historically, the cactus ferruginous pygmy-owl was reported as occupying cottonwood-willow woodlands or mesquite bosques as far north as the confluence of the Salt and Verde Rivers (Arizona Game and Fish Department in prep.). Recent observations have been restricted to Sonoran Desertscrub habitats characterized by braided-wash systems and dense vegetation including ironwood, paloverde and mesquite. While historically they were documented in cavities of cottonwoods, willows, or mesquites, recent nest sites have been in saguaro cavities. The cactus ferruginous pygmy-owl is crepuscular/diurnal and can be heard calling in the early morning and in the early evening, particularly during breeding season, which lasts from approximately January through early June (Abbate et al. 1996, U.S. Fish and Wildlife Service 1999). Critical habitat has been designated by USFWS in Pima and Pinal counties.

Table III-15 is a summary of five criteria that were used in assessing the suitability of habitat among the M&I entities for the pygmy-owl. The greater the value for each of these five parameters, the better the habitat for the pygmy-owl.

Table III-15
CAP Allocation Draft EIS
Summary of habitat variables that may be important to the cactus ferruginous pygmy-owl within M&I entities. Data are for the Bursage/Foothills Paloverde Association (BLM 1999).

M & I	Avg. fhd per site	% frequency bursage	% frequency creosote-bush	% frequency foothills paloverde	avg. tree density per acre
Peoria	70	72	65	20	4.5
Surprise	67	79	47	29	0.8
Goodyear	53	20	94	20	2.8
Cave Creek	70	53	19	31	0.3
Phoenix	54	82	54	09	1.0
Scottsdale	59	86	30	17	1.3
Apache Jnct.	53	90	73	18	2.6
Superior	54	87	24	10	3.3
Oro Valley	87	35	23	25	2.2
Avra	110	20	90	20	2.6
Tucson	98	75	45	21	1.2

The USFWS announced the availability of its recommended guidance for private landowners concerning the cactus ferruginous pygmy-owl and the survey protocol in the FR on March 20, 2000 (65 FR 14999-15000). Depending on the location of the clearing or land disturbance activity, two consecutive years of surveys may be required.

III.E.3.d.(6) Lesser Long-nosed Bat

The lesser long-nosed bat is one of three leaf-nosed bats that occur in desertscrub habitat in central and southeastern Arizona below 6,000-foot elevation. Its wingspan averages approximately 14 inches and it has an elongated muzzle, small leaf nose, very short tail, and long tongue. The fur is yellowish-brown or gray above and cinnamon-brown below. This bat is migratory, being present in Arizona from approximately April to September, and roosting in caves and abandoned tunnels. This species is easily disturbed. Females mate in Mexico during the winter and are pregnant when they arrive in Arizona, where they congregate in maternity colonies. Agave and columnar cacti serve as food-source plants for this pollen and nectar eating species. Lesser long-nosed bats may occur in Pima, Santa Cruz, Graham, Pinal, and Maricopa Counties.

III.E.3.d.(7) Nichol's Turk's Head Cactus

The Nichol's Turk's head cactus is a blue-green to yellowish-green columnar cactus that is 18 inches tall and has an eight-inch diameter. The spine clusters have five radial and three central spines (with one downward short spine and two upward spines that are red or gray). The flowers are pink and the fruit is wooly white. This cactus can be found in unshaded microsites in Sonoran Desertscrub, on dissected alluvial fans, or at the foot and saddles on limestone mountains; at elevations from 2,400-4,100 feet in Pinal, Pima, or Yuma Counties.

III.E.3.d.(8) Pima Pineapple Cactus

The Pima pineapple cactus has hemispherical stems four to seven inches tall and three to four inches in diameter. The central spines are about one inch long, hooked at the end, and straw colored, with 10-15 radial spines in older plants. Stems are usually solitary but can occur in clusters. Flowers are yellow, salmon or rarely white. This cactus is found in the Sonoran Desertscrub or Semi-Desert Grassland communities at 2300-5000 feet in Pima County from Baboquivari Mountains east to the Santa Rita Mountains in Santa Cruz and Pima counties. Most known locations are associated with the Tucson basin.

III.E.3.d.(9) Southwestern Willow Flycatcher

The southwestern willow flycatcher is a small, neotropical migratory bird, approximately six-inches long, with grayish-green back and wings, a whitish throat, light olive-gray breast, and a pale yellowish belly. It has two wingbars and the eye ring may be faint or absent. The flycatcher arrives in Arizona from late April to early May and usually leaves in September. In general, southwestern willow flycatchers nest in areas near surface water or saturated soil in dense, closed-canopy stands of riparian vegetation. Critical habitat is designated on portions of the 100-year floodplain on the San Pedro and Verde Rivers, the Colorado River, and the Little Colorado River in the higher elevations near Greer.

III.E.3.d.(10) Yuma Clapper Rail

The Yuma clapper rail is found at elevations below 4,500 feet in brackish and freshwater marshes with emergent vegetation that usually includes cattails or bulrushes. The Yuma clapper rail has long legs, a short tail, and a long slender decurved bill. Its plumage is mottled brown on gray on its rump, with dark gray with vertical streaking that produces a barred look on its flanks and undersides (U.S. Fish and Wildlife Service 1999). Calling activities peak in February and most eggs hatch in early June. Dense, herbaceous vegetation is needed for its nesting and foraging. Crayfish are its main food source in Arizona. Yuma clapper rails have been found on the Gila River just downstream of the confluence of the Salt and Gila rivers, and in isolated areas on the Verde River in the Verde Valley.

III.E.4. Environmental Consequences

Impacts to biological resources would include direct impacts from construction of CAP delivery facilities, and development of new irrigated lands on the Indian Reservations. Direct impacts for each entity, based upon available plans, are described in Appendix L. Since final construction plans are not available, Reclamation will carry out supplemental environmental review, pursuant to NEPA and ESA for these construction impacts when final plans are available (see Chapter V). Indirect impacts from retirement of irrigated lands due to economic conditions vary only in timing among alternatives. Under the No Action Alternative and all action alternatives, loss of habitat associated with land use changes in the M&I and NIA service areas would also occur. Land use changes due to continued urban growth are identical under all alternatives. A general description of the types of impacts to biological resources follows. Table III-12 in Chapter III-D.4- Land Use, quantifies the acreage of land use changes for each of these types of impacts.

III.E.4.a. Development of desertlands for agriculture

Development of agriculture would occur only on Indian Reservations, and would vary in the amount of acreage, depending upon the action alternative. For purposes of evaluating a worst-case scenario, it has been assumed all agricultural development resulting from any of the proposed allocations would occur on native desert. As many as 50,000 acres of new irrigated farmland could be developed as a result of water allocated to Indian Tribes (see Table III-12). Associated infrastructure would likely include pipelines, irrigation and drainage canals, lateral canals and field ditches. This would result in direct loss of Sonoran Desertscrub Biome and associated habitat types. The impacts to wildlife would depend on the condition and quality of the habitat at the time of development. Indirect impacts from the fragmentation and isolation of the remaining natural habitat and loss of wildlife movement corridors may also occur. Degradation may occur in undeveloped habitat adjacent to the developed areas. Some of the possible impacts to wildlife and/or their habitat include increased road kills, exposure to human disturbance such as off-road vehicle (ORV) activities, hiking, free-roaming pets, and the possible introduction of non-native species.

III.E.4.b. Conversion of desert to urban uses

Urbanization will continue in each of the 21 M&I entities' MPAs and/or water service areas. The rate of growth would be identical under all of the alternative allocations, so the acres urbanized would be the same under all alternatives, including No Action. This would result in direct loss of Sonoran Desertscrub Biome and associated habitat types. The impacts to wildlife would depend on the condition and quality of the habitat at the time of development. Indirect impacts from the fragmentation and isolation of the remaining natural habitat and loss of wildlife movement corridors may also occur. Degradation may occur in undeveloped habitat adjacent to the developed areas. Some of the possible impacts to wildlife and/or their habitat include increased road kills, exposure to human disturbance such as ORV activities, hiking, free-roaming pets, and the possible introduction of non-native species. Appendix L provides additional details on each M&I planning area.

III.E.4.c. Conversion of agricultural lands to urban uses

Agricultural lands, within the M&I MPAs and/or water service areas and within the IDs, will continue to be urbanized over the 50-year study period. The rate of urbanization is identical under all the alternatives. Natural habitat and wildlife impacts should be minimal. However, some species, such as burrowing owls that often utilize fallow fields for nesting, would be adversely affected.

III.E.4.d. Conversion of agricultural lands to fallow fields

Under the different alternatives, varying amounts of irrigated farmland would be fallowed due to economic conditions resulting from changes in the availability and cost of CAP water for the NIA sector. Through natural revegetation processes, these fallow fields can provide fair wildlife habitat in the long term. Restoration or revegetation with native species would enhance this process if these fields are not developed in the future. Growth of noxious weeds could create a nuisance that would need to be managed.

III.E.4.e. Impact to riparian areas from reductions in effluent discharge

Under Non-Settlement Alternatives 2 and 3, 65,647 afa of M&I priority water would be reallocated from M&I users to Indian Tribes and communities. An evaluation was made to determine if the cities would likely utilize effluent as a substitute for this water supply, with potential adverse impacts to the riparian communities that depend on effluent discharges (e.g., the Salt River below 91st Avenue WWTP or the Santa Cruz River downstream of the Roger Road WWTP). Appendix L provides a water budget for each municipality, which estimates future effluent use under each alternative. In total, the increased reuse of effluent under Alternatives 2 and 3 is 27,500 afa in year 2051. This reuse of effluent would not require any reduction in effluent discharge to streams over current levels, since it represents increases from future population growth. Therefore, the allocations would not impact any existing riparian habitats which depend on effluent discharge.

III.E.4.f. Impacts to Colorado River mainstem

All CAP water diversions currently occur at Parker Dam. Under Non-Settlement Alternatives 2 and 3, a total of 13,500 af of CAP water would be allocated and contracted to the Navajo Nation and Hopi Tribe. This water would most likely be delivered from a diversion from Lake Powell. Based upon the anticipated use for M&I purposes, it is estimated this would result in a constant diversion of less than 20 cfs.

The estimated change in depth in the river's water surface between Lake Powell and Lake Mead, associated with this 20 cfs diversion, was calculated to range between 0.004 and 0.01 inches (see Appendix J). Based upon the incremental change in water surface elevation, the impacts to aquatic and other wildlife would be inconsequential.

III.E.5. Impacts to T&E species

Reclamation has determined that the allocation alternatives considered in this draft EIS would have no effect on T&E species. This determination is based on the following:

- The alternative reallocations of CAP water would have no effect on urban population growth (see Appendix C). Accordingly, there would be no effect on T&E species from the water allocations to the M&I entities. This is not meant to imply that continued urban growth would have no effect on T&E species -- only that such urban growth would be the same under any of the allocation alternatives, including no action. Each municipality would need to comply with the relevant provisions of the Endangered Species Act for urban growth related issues. Appendix L identifies those M&I entities that have potentially suitable habitat for T&E species within their planning areas.

- The retirement of agricultural lands which may result from the alternative allocations would have no effect on T&E species.

- It is premature to consult on potential impacts to T&E species that could result from the development of agricultural lands or other CAP related developments on Indian reservations. It is not possible to identify the areas of potential impact at this time, since the specific locations of Indian agricultural and other developments are not known. Reclamation will carry out specific Section 7 evaluations for future Federal actions (Tribal water service contracts, federally funded construction) once specific development plans are identified. Appendix L provides available information on potential T&E species impacts for each Tribe.

- It is premature to consult on potential impacts to T&E species that could result from construction of new CAP water delivery facilities to M&I allottees. The specific areas that may be affected by such facilities cannot be identified at this time. Reclamation will carry out specific Section 7 consultations for each M&I subcontract (or subcontract amendment) for any new delivery facilities which may affect T&E species. Appendix L provides currently available information on necessary water delivery facilities for each M&I entity.

III.F. CULTURAL RESOURCES

III.F.1. Introduction

A cultural resources overview was completed for the 35 CAP entities including 21 M&I entities, nine NIA users, and five Indian Tribes that could receive CAP water under the proposed allocation. The overview provides an initial summary assessment of known and / or projected cultural resources located in the areas of these entities that might be affected by the proposed allocation.

III.F.2. Impact Analysis Methodology

A summary culture history of the project areas was prepared to provide a historic context for the cultural resource data (see Appendix G). Site and project maps on file at Archaeological Consulting Services, Ltd. (ACS), the State Historic Preservation Office (SHPO), and the Arizona State Museum (ASM) were checked to determine the extent of archaeological survey coverage and the location of known cultural resources for each individual entity, including the presence of archaeological and / or historic districts that are listed on the National and / or State Register of Historic Places. It should be noted that other repositories throughout Arizona (e.g., the BLM, the Forest Service, Northern Arizona University [NAU]) maintain their own site and project records, not all of this documentation is duplicated at ASM and SHPO. The cultural sensitivity designations derived from the map check must be understood as merely a starting point for estimating the magnitude of potential effects at this stage of the planning process.

The map check focused on non-urban areas, as defined by Reclamation. Information on specific site types and specific surveys were not desired at this stage of the planning process, nor did the limited time frame available to complete this overview allow for assembling data at such level of detail. Site locations were marked on USGS 7.5 minute topographic quadrangles (quad). The classification system initially sought to identify areas of low (<2 sites per mi^2), moderate (3 to 5 sites per mi^2), or high (>6 sites per mi^2) cultural resource density. However, the nature of human occupation in the area affected by the proposed allocation is such that a single "site" might extend over an entire section; in such cases, the area was classified as having high or moderate cultural resource sensitivity based on the preparer's judgment. The cultural sensitivity data were then marked on individual entity maps, that are included in Appendix L.

Because of the highly sensitive nature of the information and confidentiality issues involving the various Tribes, no attempt was made to obtain locational data regarding cultural resources or traditional cultural places on Tribal lands. It should be noted that some USGS 7.5' minute quad maps on file at SHPO are classified as restricted at the request of various Indian Tribes whose lands extend onto map boundaries; these quad maps were not reviewed. Additionally, some maps were not on file at either ASM or SHPO; others were available only at one agency. Data for the relevant portions of entities that could not be found at either ASM or SHPO were derived solely from site and project information on file at ACS.

Surveyed areas were noted to estimate the current level of coverage for each entity. However, a comprehensive evaluation of the adequacy of survey coverage for each entity was not addressed. Representative examples of the types of archaeological work done in each entity were cited whenever possible. It should be noted that the presence of cultural resources in an area does not necessarily reflect the extent of survey coverage; many sites that were mapped and recorded during the late 1800s and early 1900s are in areas that have not been systematically examined.

Planning department officials for each of the 21 M&I entities were contacted to ascertain the existence of local laws or regulations pertaining to the preservation of cultural resources. Some municipalities (e.g., Scottsdale, Mesa, Glendale, and Tempe) have rules currently in place; others (e.g., Phoenix) are in the process of compiling written historic preservation plans to be implemented in cultural resource compliance projects. When available, this information was included in the individual entity descriptions. Individual entity descriptions are contained in both Appendix G and Appendix L.

Impacts were assessed based on known cultural resource density, extent of survey coverage, potential for buried deposits, and information regarding projected uses for the CAP water under each of the proposed alternatives. It was assumed that any change in land use (e.g., urbanization of farmland), ground-disturbing activities (e.g., well-drilling), and activities that might alter the landscape (e.g., flooding), would potentially affect cultural resources.

Many archaeological sites are also traditional cultural places (TCPs) or sacred sites associated with present-day Native American ceremonial activities. There are other areas such as certain landscapes or areas where traditional plants have been and continue to be collected that may also qualify as TCPs. Locational information about these places is often confidential (for example, refer to the American Indian Religious Freedom Act of 1979 and Executive Order 13007 that addresses Federal compliance with sacred sites), and permission to conduct a records check at Tribal historic preservation offices to identify these areas must be requested from each Tribal historic preservation office. Not all Tribes have a historic preservation office, however. In these cases, consultation regarding TCPs and sacred places must be conduced with designated Tribal elders. Regardless, adequate time must be allowed for these consultations, particularly when consulting with Tribal elders.

Identification of TCPs and sacred places for all affected project sectors was beyond the scope of the present study. No attempt was made to discover site density or degree of survey coverage within Tribal sectors. Because site record access was relatively easy, basic survey coverage was obtained for many of the non-Tribal entities, but no information on TCPs was obtained. Tribal consultation regarding the location of sites, TCPs sacred places and other areas that may need to be avoided will be implemented as soon as possible pending decisions regarding implementation of a given alternative. It should also be noted that TCPs are applicable to other ethnic groups and not only to Native Americans. TCP consultation must try to identify and consult with as many potentially affected groups as possible.

Indian Trust Assets (ITAs) must also be considered, but like TCPs and sacred sites, until a ROD is made, current project information is too general to aid in assessing ITAs.

All relevant information for each of the 35 entities is summarized in Appendix G. Potential cultural impacts under each alternative are also summarized in Appendix G.

III.F.3. Affected Environment

III.F.3.a. M&I Sector

The MPAs and/or service areas of the 21 M&I entities contain a variety of landscapes from highly urbanized to native desert. Prior to the arrival of non-Indians, these lands were essentially identical to those discussed below in the Indian Sector. Many could have been considered areas of high cultural resource sensitivity; some remain so today. Development and urban growth over the last 100 years have eliminated the native desert landscapes of some of the M&I areas, covering over, if not completely removing, many of the cultural resources once present in these areas. Reports by archaeologists from the late nineteenth and early twentieth centuries--prior to intensive agricultural and the beginning of urban development-- reveal that entities such as Phoenix, Glendale, Scottsdale, Mesa, Chandler, and Tucson contained significant, sometimes extensive, cultural resources. Initially, these were mostly plowed over as agriculture rapidly expanded. Eventually, the fields began to be built over, paved over, and ultimately re-landscaped to meet the needs of growing metropolitan and urban development. Other M&I entities located in more rural areas of central and southern Arizona retain varying amounts of native desert landscapes and their associated cultural resources. As is true of central and southern Arizona in general, areas adjacent to reliable sources of water usually contain (or contained) high densities of cultural resources. These areas, favored by prehistoric and protohistoric Indian farmers for building their villages and farms, were, not surprisingly, also the first choice of non-Indian farmers and developers upon entering these areas.

In spite of more than 100 years of often intensive development, intact cultural resources are present in portions of some of the M&I entities beneath the veneer of twentieth century urbanization. In downtown Phoenix, as one example, recent construction projects revealed not only the remains of late nineteenth century downtown Phoenix, but underneath these, considerable evidence of much earlier prehistoric Hohokam occupation. In rural areas where development has been less intensive and perhaps more localized, the chances for finding intact, relatively undisturbed cultural resources are obviously greater.

It should be noted that with the influx of Euro-Americans from a variety of cultural backgrounds and the subsequent development of new communities, traditional cultural places and new cultural landscapes associated with some of these newcomers may be present in the areas of some of the M&I entities. Conversely, places that may have once held significance to Native Americans are likely to have been destroyed by development, particularly in the metropolitan and urban entities. In rural areas, where there has been considerably less development, as well as more restricted spatial development, there is a greater likelihood for identifying traditional cultural places associated with specific Native American groups.

Specific cultural resource information for each of the 21 M&I entities is available in Appendices G and L. Maps showing areas within each entity with greater cultural resource sensitivity are included in Appendix L.

III.F.3.b. NIA Sector

Much of the NIA land is located away from major metropolitan and urban areas. Some of this land is located on or near areas that were used by Hohokam farmers and that today are being supplied water from canals that follow their prehistoric predecessors. As canals and laterals were extended, wells drilled, or both, additional agricultural lands were developed in desert areas that were previously sparsely populated or unoccupied in prehistoric times. Nonetheless, cultural resources can be found in many of the NIA sectors in spite of decades of plowing and irrigation. Beneath the plowzone, intact prehistoric villages can often be found in excellent condition with varying degrees of damage depending on how deeply the remains are buried. This situation is similar to that in some of the downtown metropolitan areas where intact cultural resources are found beneath streets and buildings.

Some of the NIA sectors are located in areas that were not intensively occupied by the Hohokam or later Native American groups, primarily because of the absence of reliable water sources. Consequently, these areas are less likely to contain the large, complex cultural resource sites that occurred along the Salt and Gila Rivers where extensive canal systems supported large prehistoric populations and delivered water to Hohokam fields. Other NIA sectors are adjacent to areas known to contain extensive prehistoric villages, and it is likely that remnants of these or other villages may be located in these sectors.

Lands in the NIA sectors that for one reason or another were never developed for agriculture, obviously offer more potential for undisturbed cultural resources, including TCPs. Additional information on the NIA sector is presented in Appendices G and L. Maps of the affected NIA sector lands, indicating known or potential areas of cultural resource sensitivity, can be found in Appendix L.

III.F.3.c. Indian Sector

For this overview, all Indian lands are considered areas of high cultural resource sensitivity. In general, the spatial boundaries of archaeological sites are defined by surface feature and artifact distribution. However, to Native American groups the land itself can be an important symbol of their shared heritage. The natural environment of specific geological landmarks, as well as larger landscapes, is an integral part of Native American lifeways. Many of these are traditional cultural places used for ceremonial as well as secular activities, and are still in use today. Some are tied to origin or creation myths, kinship, and clan affiliations. Others might serve as physical reference points associated with stories and songs used to convey traditional history and detail proper behavior. Thus, not only the preservation of cultural resources, but also the preservation of the natural landscape, plays a vital part in the preservation of traditional historical knowledge (36 CFR 60.4/National Register Bulletin 38).

Because many archaeological sites also are TCPs associated with present-day Native American ceremonial activities, locational data regarding these properties are often confidential (see American Indian Religious Freedom Act of 1978). Permission to conduct a Tribal records check for purposes of compiling such information must be requested from the individual tribes, and sufficient time must be allowed for Tribal response. Given the limited time frame involved, this was beyond the scope of

the present study. Therefore, no attempt was made to discover site density or degree of survey coverage within the Tribal entities. Tribal consultation regarding location of sites, TCPs, and other areas to be avoided should be implemented at a sufficiently early future stage of the planning process to allow adequate opportunity for the Tribes to respond and ensure the undertaking meets cultural resource compliance guidelines within these entities.
Because of the complex nature of past aboriginal settlement in the Southwest (see Appendix G), various Tribes claim cultural affinity with areas outside their currently designated reservation boundaries. To assist the compliance process, maps showing the areas of cultural affinity claimed by the various Arizona Tribes are included as part of Appendix G. It should be noted that these maps, prepared by ASM, do not include information for all Tribes. The maps, and the accompanying list of Tribal leadership and cultural resource division contacts (prepared by SHPO) (see Appendix G, Attachment A) should be considered a starting point for identifying all potential consulting parties in this undertaking.

Both Appendix G and Appendix L include information on the Indian Tribes that could receive water under the proposed allocation. Figures identifying the cultural resources sensitivity areas for each Indian Tribe also are included in Appendix L.

III.F.4. Environmental Consequences

At this stage of the planning process, only general information exists regarding the portions of each entity that might be affected by the proposed allocation and contract execution. Therefore, no entity-specific recommendations can be made. The following assessment of potential impacts to the cultural resources is by necessity expressed in general terms and might be applied to all entities.

Impacts to the cultural resources within the areas of individual entities are expected to be similar under all proposed alternatives, although the acreage of new agricultural lands on Indian Reservations varies among the alternatives. Since any ground-disturbing activities have the potential to impact known and/or as yet undiscovered cultural resources, cultural impacts can be anticipated in any undertaking involving 1) urbanization of farmland, an action which has the potential to adversely impact intact cultural deposits that might still exist below the plowzone; 2) subjugation of natural desert for agriculture, an action which has the potential to adversely impact intact cultural deposits presently on the surface and within the plowzone; and 3) any related ground-disturbing activity that might result from implementation of the proposed allocation.

As stated in the introduction to this chapter, direct impacts would be those impacts that would occur as a direct result of the proposed allocation and contract execution, an example being land-disturbing activities associated with the construction of facilities needed to take, treat, and deliver CAP water. Construction-associated impacts to archaeological resources would result from such anticipated activities as excavation, temporary stockpiling, and disposal of earthen materials; manufacture or delivery of concrete; construction of concrete-lined canals, turnouts, siphons, flood protection berms, dikes, reservoirs, pipelines, water-treatment plants, wells, and pumping stations; and modifications to existing canals and equipment. These impacts would be quantified once specific plans are known. Compliance with the NHPA would be completed at that time.

No additional adverse effect is anticipated to cultural resources located in currently agricultural acreage that is to remain under cultivation or allowed to go fallow and abandoned. An exception would involve the construction of new field irrigation features like laterals or sprinklers that would require excavation beneath the existing plowzone. Subjugation of previously undisturbed (desert) land for agriculture would directly impact surface cultural remains and might impact buried deposits within the plowzone. Likewise, urbanization of land presently used for farming could potentially impact any intact cultural deposits currently preserved below the plowzone.

Adverse effects are also expected to occur from activities that have the potential to alter the landscape, such as mineral extraction and the construction of permanent features such as recharge basins. Direct impacts to archaeological sites resulting from any of these activities would be long-term and permanent.

III.F.5. M&I Sector

III.F.5.a. No Action Alternative

Under the No Action Alternative, urban growth is expected to continue. An estimated 240,000 acres would be converted from desert to urban uses and 68,150 acres from agricultural to urban uses within the 21 M&I planning areas over the 50-year study period. Such growth would have impacts on the cultural resources, as outlined above. Avoidance or mitigation of cultural resource impacts would be the responsibility of the local jurisdictions. Information on local ordinances with respect to the cultural resources is outlined in Appendix L.

III.F.5.b. Settlement and Non-Settlement Alternatives

The level of urban growth would be as described under the No Action Alternative. Reclamation would consult under NHPA Section 106 only for those actions that are directly related to taking CAP water deliveries (i.e., facilities necessary to tie into the CAP canal and take and treat the water). Impacts to the cultural resources resulting from urban growth are not a consequence of the proposed allocation. They would occur regardless of the allocation decision.

III.F.6. NIA Sector

III.F.6.a. No Action Alternative

Under the No Action Alternative, an estimated 46,900 acres of farmland are expected to be urbanized within the nine NIA districts over the 50-year study period. An additional 40,926 acres are expected to be fallowed and left undeveloped as a result of economic conditions.

III.F.6.b. Settlement and Non-Settlement Alternatives

The level of urbanization would be as described under the No Action Alternative. Avoidance or mitigation of cultural resource impacts associated with urbanization would be the responsibility of the local jurisdictions. Information on local ordinances with respect to the cultural resources is outlined in Appendix L.

III.F.7. Indian Sector

III.F.7.a. No Action Alternative

No additional CAP water would be provided to the Tribal entities under the No Action Alternative. No additional impacts to the cultural resources would result.

III.F.7.b. Settlement and Non-Settlement Alternatives

The potential for delivery facilities and agricultural development on the reservations that could occur as a result of proposed allocations is summarized by Indian Tribe as follows (see Appendices G and L for additional detail).

III.F.7.b.(1) GRIC

Under the Settlement Alternative, Non-Settlement Alternative 2, and Non-Settlement Alternative 3, the GRIC would receive additional CAP water. Under the Settlement Alternative, an estimated additional 20,800 acres would be subjugated for agriculture. Under Non-Settlement Alternative 2, an estimated additional 16,700 acres would be subjugated for agriculture. Under Non-Settlement Alternative 3, an estimated additional 38,000 acres would be subjugated for agriculture. The lands to be developed, and the appurtenant facilities to be constructed, are identified in the PMIP PEIS (Reclamation). Under Non-Settlement Alternative 1, the GRIC is the only Tribe to receive an allocation, and would receive an additional 17,000 af of water, which would be used for irrigation as part of PMIP PEIS. Under Non-Settlement Alternative 1, an estimated additional 8,000 acres would be subjugated for agriculture. National Historic Preservation Act (NHPA) Section 106 compliance is being carried out as part of the PMIP, in which Reclamation is directly involved.

III.F.7.b.(2) TON

Under the Settlement Alternative, Non-Settlement Alternative 2 and Non-Settlement Alternative 3, the TON would receive additional CAP water (23,000 afa to San Xavier District and 5,200 afa to Schuk Toak District). Under each of these three Alternatives, an estimated 4,000 acres would be developed for agriculture. It is also anticipated that some of this CAP water would be made available for recharge on-reservation; facilities associated with this use include infiltration basins, pipelines, and pumps. Other possible uses include growing mesquite, habitat enhancement, river restoration, recreation, and mining. Because Reclamation is directly involved in implementing the CAP distribution facilities (through funding) for both districts, NHPA Section 106 consultations would be carried out, and mitigation plans developed.

III.F.5.b.(3) SC Apache Tribe

The SC Apache Tribe would receive additional CAP allocation only under Non-Settlement Alternatives 2 and 3. Under Non-Settlement Alternative 2, an estimated 4,700 acres would be developed for agriculture. Under Non-Settlement Alternative 3, an estimated 8,000 acres would be developed for agriculture. Additionally, some of the allocated water could be used for aquaculture, fish hatchery, livestock grazing, mining of peridot and gypsum, and maintenance of a minimum pool within the San Carlos Reservoir; these uses would reduce the amount of agricultural acreage accordingly. Facilities would include construction of pump stations and pipelines, disturbing approximately 750 acres.

III.F.7.b.(4) Navajo/Hopi

The Navajo / Hopi would receive additional CAP water only under Non-Settlement Alternatives 2 and Non-Settlement Alternative 3. It is anticipated CAP water would be diverted to users via the Western Pipeline or the Lake Powell Pipeline. It is estimated that construction of the necessary distribution lines to supply the water would impact an estimated 3,100 acres if both pipelines are constructed (1,100 acres for the Western Pipeline and 2,000 acres for the Lake Powell Pipeline).

III.G. AIR QUALITY

The proposed allocation would result in minor short-term increases in air emissions associated with construction of water conveyance and associated support facilities. Those short-term air emissions are addressed qualitatively because specific information regarding the type, number, and location of additional water transfer conveyance facilities is currently unknown. The long term direct effects of water transfer are expected to be negligible. The long term indirect air quality effects associated with water allocation-induced economic activity could be substantial; however, due to the timeframe in which they would occur (year 2043 and beyond) and the uncertainty of conditions and standards that may apply at that time, these impacts are discussed at a programmatic level.

III.G.1. Impact Analysis Methodology

The air quality analysis focuses on estimating criteria pollutant emissions associated with economic development resulting from each of the alternatives, including the No Action Alternative. The objective is to evaluate whether each action alternative would significantly increase emissions when compared to the No Action Alternative, which is the baseline for assessing project impacts. Appendix H contains a detailed description of the methodology used for this analysis.

Air emissions were estimated for ozone (O_3) precursors (reactive organic gases [ROG] and oxides of nitrogen [NOx]), for carbon monoxide (CO), and for respirable particulates (particulate matter less than 10 microns in diameter or PM_{10}). O_3 (and its precursors), CO, and PM_{10} constitute the pollutants of most concern in Arizona and are the pollutants that would be generated by water-allocation-induced economic development.

Changes in air emissions would potentially result from changes in agricultural production by Indian Tribes and NIA users. For changes in agricultural water use, emissions were calculated based on changes in crop acreage using agricultural emission inventories and emission factors for agricultural activities. The socioeconomic study (Appendix D) provided agricultural production estimates that were used for this analysis. Because none of the action alternatives are expected to either stimulate or reduce growth rates for the M&I entities, future air emissions associated with these entities would not change beyond what is currently projected to occur under No Action.

The factors that were considered in evaluating potential impacts included identifying whether or not an alternative would result in a net increase in emissions that exceed certain levels. For each alternative, emissions are subdivided by location based on whether emissions are within an attainment versus a non-attainment area. Non-attainment areas are those that violate the Federal and Arizona ambient air quality standards.

Significance thresholds were developed for use in this analysis as benchmarks for assessing the magnitude of air pollution emissions associated with each alternative. These thresholds were developed based on the county in which the emissions would occur, the type of pollutant, and the attainment status for each affected county. If the affected county is currently in a nonattainment status for a specific criteria pollutant, the general conformity threshold for that pollutant was used. If the affected county is in an attainment status for a pollutant, new source review (NSR) thresholds were used. NSR requirements apply to new stationary sources of pollution, such as power plants or factories, that generate new emissions from a specific location. For this project, NSR requirements would not be applicable because the sources of emissions would be classified as area sources. NSR thresholds are only being used in this analysis to provide perspective on the magnitude of air impacts in attainment areas.

III.G.2. Existing Conditions

Air quality is evaluated by measurement of ambient concentrations of pollutants that are known to have deleterious effects. The U.S. Environmental Protection Agency (EPA) has promulgated primary and secondary National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: CO, nitrogen dioxide (NO_2), PM_{10}, O_3, sulfur dioxide (SO_2), and lead. Primary standards are adopted to protect public health, while secondary standards are adopted to protect public welfare (Arizona Department of Environmental Quality [ADEQ] 1998). States are required to adopt ambient air quality standards that are at least as stringent as the Federal NAAQS. The ADEQ is responsible for regulating air quality in the State and has adopted the Federal NAAQS as State standards.

As of July 1, 1997, EPA had revised the standards for O_3 and particulate matter to ensure a more effective and efficient protection of public health and the environment. These revised standards are an eight-hour O_3 standard of 0.08 ppm, a 24-hour standard for $PM_{2.5}$ (particulate matter with a diameter of 2.5 microns or smaller) of 65 micrograms per cubic meter ($\mu g/m^3$) and an annual $PM_{2.5}$ standard of 15 $\mu g/m^3$ (ADEQ 1998). However, the revised O_3 and particulate matter standards are currently on hold pending resolution of ongoing litigation.

Portions of the study area are located in areas designated as non-attainment for Federal O_3, CO, and PM_{10} standards. The applicable *de minimis* thresholds are 25 tons per year (tpy) of reactive organic gases and nitrogen oxides, 100 tpy of CO, and 70 tpy of PM_{10}. If implementation of an alternative would result in total direct and indirect emissions in non-attainment areas in excess of the de minimis emission rates, it must be demonstrated that the emissions conform to the applicable State Implementation Plan (SIP) for each affected pollutant. If emissions would not exceed the de minimis levels, and are not regionally significant, then the project is presumed to conform, and no further analysis or determination is required.

Maricopa County is designated by EPA as a non-attainment area for CO, O_3, and PM_{10} (see Table H-1 in Appendix H) (ADEQ 1998). Maricopa County was reclassified as a “serious” CO non-attainment area in August 1996, and serious PM_{10} non-attainment area in June 1996, and was classified as a “serious” non-attainment area for O_3 in February 1998 (ADEQ 1998). The required CO SIP was submitted to EPA on July 8, 1999. A PM_{10} SIP for the 24-hour standard was submitted to EPA in May 1997. The MAG submitted a complete serious area PM_{10} SIP to EPA on July 8, 1999, which addressed both the 24-hour and annual standards. The Plan included an extension request for attainment for no longer than December 21, 2006. On August 3, 1998, EPA published in the FR a final rule promulgating a Federal implementation plan (FIP) to address the moderate area PM_{10} requirements for the Phoenix PM_{10} non-attainment area because the area does not have an EPA-approved PM_{10} moderate area plan.

Pinal County is designated as an attainment area for all criteria pollutants except PM_{10}. The county is in attainment of PM_{10} standards for all areas except the Hayden-Miami area, which is classified as moderate non-attainment.

Pima County is designated as an unclassifiable area for CO. The last violation of the CO NAAQS occurred in 1984. A CO maintenance plan was submitted to EPA on April 21, 1996. The Plan has been deemed complete and is undergoing EPA review. Once approved, the area would be re-designated to attainment.

The remainder of Arizona is generally in attainment of NAAQS with the exception of several small areas that are classified as moderate nonattainment for PM_{10}. These areas include the Nogales nonattainment area in Santa Cruz County, the Hayden-Miami and Payson nonattainment areas in Gila County, the Paul Spur-Douglas nonattainment area in Cochise County, the Yuma nonattainment area in Yuma County, and the Bullhead City nonattainment area in Mohave County.

III.G.3. Impacts

III.G.3.a. No Action Alternative

Under the No-Action Alternative, activities within the three sectors would continue into the future consistent with current projections. The M&I entities would continue to grow in size and area as currently projected by the planning agencies for those entities. Non-Indian and Indian agricultural production would continue to decline or grow as dictated by projected water availability and economic conditions. Air quality conditions for current and future years under this alternative are described below for Maraicopa, Pinal and Pima counties[47]. The portion of Gila County that would be affected by this project is not within a non-attainment area; therefore, no further discussion is provided for this county.

Maricopa County is currently classified as non-attainment for the Federal O_3, CO, and PM_{10} ambient standards. SIPs have been prepared that are designed to bring the County into attainment with those standards. Within Maricopa County PM_{10} SIP control measures would be implemented to control emissions from agriculture and other fugitive dust sources. Those control measures are expected to result in no net increase in PM_{10} emissions from those emission categories beyond 2010. Similarly, increases in CO and O_3 precursor emissions would be limited by the respective O_3 and CO SIPs. The CO, O_3, and PM_{10} SIPs have been prepared using assumptions similar to those under the No Action Alternative. Therefore, the No Action Alternative would either not result in emission increases or would limit those increases to within emission budgets developed to bring Maricopa County into compliance with the national ambient air quality standards.

Table III-16 shows mobile source emissions in Maricopa County estimated as part of the most recent transportation conformity analysis (Maricopa Association of Governments 1999). The emission estimates show that Maricopa County's projected transportation improvements, which are consistent with the No Action Alternative, would not cause or contribute to violations of the Federal ambient air quality standards because emissions would be within the County's transportation emissions budgets.

Table III-17 shows agricultural and fugitive dust emissions in Maricopa County. The emissions from these two sectors are relatively small compared to mobile source emissions and, due to proposed SIPs, are not expected to increase substantially beyond 2010.

[47] Estimated air emissions data that are presented in Tables Air 8 through Air-11 were calculated to the year 2020.

Table III-16
CAP Allocation Draft EIS
Maricopa County Mobile Source Emission Projections (tpy)

Year	ROG	NOx	CO	PM_{10}
2000	75.6	103.2	436.0	206.0
2010	69.4	94.7	420.0	260.0
2020	77.5	105.8	462.0	309.0
Budget	84.5	Not Applicable	565.0	Not Applicable

Notes: Emission estimates for ROG, CO, and PM_{10} based on the Maricopa Association of Governments 1999. Emission estimates for NOx based on EPA's 1996 emission inventory for Maricopa County (U.S. EPA. undated). The ratio of NOx to ROG mobile source emissions for Maricopa County in 1996 was used to estimate mobile source NOx emissions in 2000.

Table III-17
CAP Allocation Draft EIS
Maricopa County Agricultural and Fugitive Dust Emission Projections (tpy)

	ROG	Nox	CO	PM_{10}
1996 – Agriculture	0.4	2.5	1.6	24.8
1996 - Fugitive Dust Sources				68.8
2000 – Agriculture	0.4	2.7	1.7	26.3
2000 - Fugitive Dust				79.8
2010 – Agriculture	0.4	3.1	2.0	30.5
2010 - Fugitive Dust				92.6
2020 – Agriculture	0.4	3.1	2.0	30.5
2020 - Fugitive Dust				92.6

Notes: Emission estimates for ROG, CO, and PM_{10} based on EPA's 1996 emission inventory for Maricopa County (U.S. EPA. Undated). Emissions in 2000 and 2010 assume 1.5% increase in emissions per year. Emissions in 2020 are assumed to remain unchanged from 2010 due to implementation of Maricopa County's PM_{10} SIP and FIP.

Table III-18 shows emissions in Pinal County under the No Action Alternative. This alternative assumes that ROG, NOx, CO, and PM_{10} would steadily increase by 1.5 percent per year through 2020.

Table III-18 CAP Allocation Draft EIS Pinal County Emission Projections (tons per day)				
	ROG	**Nox**	**CO**	**PM_{10}**
1996 – Agriculture	0.3	2.0	1.3	17.7
1996 - Fugitive Dust				29.2
1996 - Mobile Sources	10.5	19.5	105.0	0.2
2000 – Agriculture	0.3	2.1	1.4	18.8
2000 - Fugitive Dust				31.0
2000 - Mobile Sources	11.1	20.7	111.4	0.2
2010 – Agriculture	0.3	2.5	1.6	21.8
2010 - Fugitive Dust				36.0
2010 - Mobile Sources	12.9	24.0	129.3	0.3
2020 – Agriculture	0.4	2.9	1.9	25.3
2020 - Fugitive Dust				41.7
2020 - Mobile Sources	15.0	27.9	150.0	0.3
Notes: Emission estimates for ROG, NOx, CO, and PM_{10} based on EPA's 1996 emission inventory for Pinal County (U.S. EPA. Undated). Emissions in 2000, 2010, and 2020 assume 1.5% increase in emissions per year.				

Table III-19 shows emissions in Pima County under the No Action Alternative. This alternative assumes that ROG, NOx, and PM_{10} would increase by 1.5 percent per year which is the annual increase assumed by EPA for this county (E.P.A. undated). CO emissions are assumed to level off after 2010 due to implementation of the Pima County CO SIP and because of the expected turnover in the vehicle fleet, which results in newer, cleaner vehicles being replaced by older, higher-emitting vehicles.

Table III-19 CAP Allocation Draft EIS Pima County Emission Projections (tpy)				
	ROG	**Nox**	**CO**	**PM_{10}**
1996 – Agriculture	0.03	0.2	0.2	3.3
1996 - Fugitive Dust				35.5
1996 - Mobile Sources	41.1	52.7	382.8	0.9
2000 - Agriculture	0.0	0.2	0.2	3.5
2000 - Fugitive Dust				37.7
2000 - Mobile Sources	43.6	55.9	406.3	1.0
2010 - Agriculture	0.04	0.3	0.2	4.1
2010 - Fugitive Dust				43.7
2010 - Mobile Sources	50.6	64.9	471.3	1.1
2020 – Agriculture	0.05	0.3	0.2	4.7
2020 - Fugitive Dust				50.7
2020 - Mobile Sources	58.7	75.3	471.3	1.3
Notes: Emission estimates for ROG, NOx, CO, and PM_{10} based on EPA's 1996 emission inventory for Pima County (U.S. EPA. Undated). ROG, NOx, and PM_{10} emissions through 2020 assume 1.5% increase in emissions per year compared to 1996. CO emissions beyond 2010 assumed to remain unchanged due to implementation of Pima County's CO SIP.				

III.G.3.b. Settlement Alternative and Non-Settlement Alternatives

Under each of the action alternatives, emissions of PM_{10}, CO, NOx, and ROG were estimated where appropriate for current and future years and compared to analysis thresholds described previously. No emissions estimates were prepared for the M&I sector because changes in the amount of water allocated to these entities would not affect growth rates projected for the individual entities. New M&I sector emissions would be limited to those associated with construction of new water conveyance structures and would be short-term in duration. Therefore, the air quality analysis focuses primarily on changes to agricultural production within the NIA and Indian sectors, both of which would experience changes in the amount of agricultural land that is in production during the 50-year study period. A discussion of construction impacts related to the M&I and Indian sectors is also provided.

III.G.3.b.(1) Settlement Alternative

Changes in agricultural production were estimated as part of the socioeconomic analysis for this project (Appendix D). This analysis estimated changes to the amount of land under production for each sector by crop type and for several specific milestone years between the present time and 2051. Changes in emissions were calculated for both agricultural activities and for fallow lands that would no longer be in production. The calculations were organized by the counties where the changes would occur. Table III-20 summarizes the air emissions that would occur under this alternative. The numbers shown in the table indicate the net change in emissions resulting from a comparison of changes associated with the Settlement Alternative and expected changes in agricultural production under the No Action Alternative.

Table III-20
CAP Allocation Draft EIS
Net Agricultural Air Emissions under the Settlement Alternative (tpy)

	Year					Analysis Thresholds	
County	**2004**	**2016**	**2030**	**2043**	**2050**	**Pre-2010**	**Post-2010**
Maricopa County							
PM_{10}	0	2	2	-11	-33	15	250
CO	0	0	0	0	-1	50	250
NOx	0	0	0	-1	-3	25	250
ROG	0	0	0	0	0	25	250
Pinal County							
PM_{10}	0	20	329*	656*	996*	250	250
CO	0	1	12	23	36	250	250
NOx	0	2	33	66	100	250	250
ROG	0	0	6	11	17	250	250
Pima County							
PM_{10}	0	-37	-17	4	24	250	250
CO	0	-1	-3	-2	-1	100	250
NOx	0	-4	-2	0	2	250	250
ROG	0	-1	0	0	0	250	250
Gila County							
PM_{10}	0	0	0	0	0	-	-
CO	0	0	0	0	0	-	-
NOx	0	0	0	0	0	-	-
ROG	0	0	0	0	0	-	-
Note: * indicate that significance thresholds would be exceeded.							

As indicated in Table III-20 above, the changes in emissions due to changes in agricultural production are relatively small in magnitude and would generally not exceed significance thresholds. The exception is Pinal County during the latter part of the 50-year study period. By 2043, PM_{10} emissions from new agricultural activities could substantially exceed current threshold standards. Follow-on NEPA documentation conducted for Indian development projects would evaluate potential air quality impacts using conditions and standards that exist and are applicable at those future points in time, including regulations related to conformity and new source review standards for sources of air emissions. That NEPA documentation will indicate that projects involving Federal funds or requiring Federal approval must comply with applicable Federal, State, and local air pollution and dust control laws, regulations and ordinances. Mitigation measures will be identified to ensure compliance with those laws. This is consistent with past and current Reclamation practice.

As mentioned previously, some construction activities associated with construction of water conveyance facilities would take place within the M&I and Indian sectors. Although the magnitude of construction associated with other projects is unknown, construction activities typically result in the generation of fugitive dust and O_3 precursors, PM_{10} and CO from construction vehicle exhaust. These pollutants are a potential concern especially since the projects would primarily be constructed in Maricopa, Pinal, and Pima Counties. Although the magnitude of construction associated with these projects is unknown, construction projects would be required to comply with Federal, State and local laws and ordinances regarding air pollution and dust control.

III.G.3.b.(1) Non- Settlement Alternative 1

Non-Settlement Alternative 1 would have similar air quality impacts compared to the Settlement Alternative although the magnitude of these impacts would be somewhat less. Increases in PM_{10} emissions would be smaller in the later years as the incremental increase in agricultural development over the No Action Alternative would be less. Changes in air emissions would be generated by both construction activities in the M&I and Indian Sectors and from changes in agricultural production in the NIA and Indian sectors. Table III-21 summarizes the net changes in emissions associated with agricultural activities.

Table III-21
CAP Allocation Draft EIS
Net Agricultural Air Emissions under Non-Settlement Alternative 1 (tpy)

	Year					Analysis Thresholds	
County	**2004**	**2016**	**2030**	**2043**	**2050**	**Pre-2010**	**Post-2010**
Maricopa County							
PM_{10}	0	2	2	2	-20	15	250
CO	0	0	0	0	0	50	250
NOx	0	0	0	0	0	25	250
ROG	0	0	0	0	0	25	250
Pinal County							
PM_{10}	0	20	85	170	255*	250	250
CO	0	1	3	6	9	250	250
NOx	0	2	9	17	26	250	250
ROG	0	0	2	3	4	250	250
Pima County							
PM_{10}	0	-23	-23	-23	-23	250	250
CO	0	-1	-1	-1	-1	100	250
NOx	0	-2	-2	-2	-2	250	250
ROG	0	-1	0	0	0	250	250
Gila County							
PM_{10}	0	0	0	0	0	-	-
CO	0	0	0	0	0	-	-
NOx	0	0	0	0	0	-	-
ROG	0	0	0	0	0	-	-
Note: * indicate that significance thresholds would be exceeded.							

As indicated, air emissions from changes in agricultural production would exceed analysis thresholds in only one instance.

Air quality impacts resulting from construction activities would similar to those described under the Settlement Alternative.

III.G.3.b.(3) Non-Settlement Alternative 2

Non-Settlement Alternative 2 would have similar air quality impacts compared to the Settlement Alternative although the magnitude of these impacts would be different. Changes in air emissions would be generated by construction activities in the Indian sector and from changes in agricultural production in the NIA and Indian sectors. Table III-22 summarizes the net changes in emissions associated with agricultural activities.

Table III-22
CAP Allocation Draft EIS
Net Agricultural Air Emissions under Non-Settlement Alternative 2 (tpy)

	Year					Analysis Thresholds	
County	**2004**	**2016**	**2030**	**2043**	**2050**	**Pre-2010**	**Post-2010**
Maricopa County							
PM_{10}	0	0	0	0	-22	15	250
CO	0	0	0	0	-1	50	250
NOx	0	0	0	0	-2	25	250
ROG	0	0	0	0	0	25	250
Pinal County							
PM_{10}	0	20	173	344*	516*	250	250
CO	0	1	6	12	18	250	250
NOx	0	2	17	35	52	250	250
ROG	0	0	3	6	9	250	250
Pima County							
PM_{10}	0	-23	-3	18	38	250	250
CO	0	-1	0	0	1	100	250
NOx	0	-2	-1	1	3	250	250
ROG	0	0	0	0	1	250	250
Gila County							
PM_{10}	1	1	1	1	1	-	-
CO	3	3	3	3	3	-	-
NOx	7	7	7	7	7	-	-
ROG	1	1	1	1	1	-	-
Note: * indicate that significance thresholds would be exceeded.							

As indicated in Table III-22 above, the changes in emissions due to changes in agricultural production are relatively small in magnitude and would generally not exceed significance thresholds. The exception is Pinal County during the latter part of the 50-year study period. By 2050, PM_{10} emissions from new agricultural activities could exceed threshold current standards. Follow-on NEPA documentation conducted for Indian development projects would evaluate potential air quality impacts using conditions and standards that exist and are applicable at those future points in time, including regulations related to conformity and new source review standards for sources of air emissions. NEPA documentation would include mitigation measures that would require projects, which involve involving Federal funds or require Federal approval, to comply with applicable Federal, State and local air pollution and dust control laws, regulations and ordinances. This is consistent with past and current Reclamation practice.

Generally, construction-related air quality impacts would be similar to those described under the Settlement Alternative. Under Non-Settlement 2, two additional major construction projects would need to be undertaken to develop delivery facilities for the CAP water allocations to the SC Apache Tribe, the Navajo Nation, and the Hopi Tribe. Construction of these facilities would generate substantial, but short-term, emissions of criteria pollutants associated with tailpipe emissions from construction vehicles and equipment, and fugitive dust. These projects are located in area that are currently in attainment for all criteria pollutants. There would be a substantial but short-term effect on local air quality. Implementation of mitigation measures would reduce the magnitude of the impact.

III.G.3.b.(4). Non-Settlement Alternative 3

Non-Settlement Alternatives 3A and 3B would have fairly identical air quality impacts with only minor differences in calculated net emissions. Changes in air emissions would be generated by both construction activities in the M&I (under Non-Settlement Alternative 3B only) and Indian sector, and from changes in agricultural production in the NIA and Indian sectors. Tables III-23 and III-24 summarize the net changes in emissions associated with agricultural activities.

Table III-23
CAP Allocation Draft EIS
Net Agricultural Air Emissions under Non-Settlement Alternative 3A (tpy)

	Year					Analysis Thresholds	
County	**2004**	**2016**	**2030**	**2043**	**2050**	**Pre-2010**	**Post-2010**
Maricopa County							
PM_{10}	0	2	2	-9	-32	15	250
CO	0	0	0	0	-1	50	250
NOx	0	0	0	-1	-3	25	250
ROG	0	0	0	0	0	25	250
Pinal County							
PM_{10}	0	20	523*	1046*	1568*	250	250
CO	0	1	19	37	56	250	250
NOx	0	2	52	105	157	250	250
ROG	0	0	9	18	27	250	250
Pima County							
PM_{10}	0	-23	-3	18	38	250	250
CO	0	-1	0	0	1	100	250
NOx	0	-2	-1	1	3	250	250
ROG	0	0	0	0	1	250	250
Gila County							
PM_{10}	2	2	2	2`	2	-	-
CO	3	4	4	4	4	-	-
NOx	12	12	12	12	12	-	-
ROG	2	2	2	2	2	-	-
Note: * indicate that significance thresholds would be exceeded.							

Table III-24
CAP Allocation Draft EIS
Net Agricultural Air Emissions under Non-Settlement Alternative 3B (tpy)

	Year					Analysis Thresholds	
County	**2004**	**2016**	**2030**	**2043**	**2050**	**Pre-2010**	**Post-2010**
Maricopa County							
PM_{10}	0	2	2	-11	-33	15	250
CO	0	0	0	0	-1	50	250
NOx	0	0	0	-1	-3	25	250
ROG	0	0	0	0	0	25	250
Pinal County							
PM_{10}	0	20	523*	1046*	1568*	250	250
CO	0	1	19	37	56	250	250
NOx	0	2	52	105	157	250	250
ROG	0	0	9	18	27	250	250
Pima County							
PM_{10}	0	-23	-3	18	38	250	250
CO	0	-1	0	0	1	100	250
NOx	0	-2	-1	1	3	250	250
ROG	0	0	0	0	1	250	250
Gila County							
PM_{10}	2	2	2	2	2	-	-
CO	3	4	4	4	4	-	-
NOx	12	12	12	12	12	-	-
ROG	2	2	2	2	2	-	-
Note: * indicate that significance thresholds would be exceeded.							

As indicated in Tables III-23 and III-24 above, the changes in emissions due to changes in agricultural production are relatively small in magnitude and would generally not exceed significance thresholds. The exception is Pinal County during the latter part of the 50-year study period. By 2030, PM_{10} emissions from new agricultural activities could substantially exceed current threshold standards. Follow-on NEPA documentation conducted for Indian development projects would evaluate potential air quality impacts using conditions and standards that exist and are applicable at those future points in time, including regulations related to conformity and any applicable new source review standards for sources of air emissions. NEPA documentation would include mitigation measures that would require projects, which involve Federal funds or require Federal approval, to comply with applicable Federal, State and local air pollution and dust control laws, regulations and ordinances. This is consistent with past and current Reclamation practice.

Construction-related air quality impacts would be similar to those described under Non-Settlement Alternative 2.

III.G.4. Summary of Air Quality Impacts

The following is a summary of air quality impacts that are described in this section.

III.G.4.a. Impacts related to urbanization/new construction

Air quality impacts associated with urbanization or new development would be limited to short-term emissions associated with construction of water conveyance structures and related facilities. These emissions would be substantial on a local level but mitigation measures can be used to reduce adverse effects. No air quality impacts are anticipated from the perspective of changes in growth patterns and rates in the individual M&I entities. Growth is expected to continue at current projected rates because of the availability of water to these entities with or without implementation of the proposed allocations.

III.G.4.b. Agricultural production

From the perspective of air quality, this activity has the highest potential for generating significant emissions of air pollutants. Changes in water allocations to NIA and Indian sectors would, to varying degrees under each alternative, generate changes in the quantity of agricultural lands put into production in central and southern Arizona. This impact would be greatest in Pinal County during the latter portion of the study period.

III.G.5. Mitigation Measures

III.G.5.a. Mitigation of Construction Impacts

Air quality impacts related to construction activities can be reduced through implementation of mitigation measures designed to reduce generation of PM_{10} at construction sites in the form of fugitive dust. Examples of these measures include the following:

- Cover, enclose, or maintain adequate soil moisture of active storage piles to prevent visible dust emissions.
- Cover inactive storage piles.
- Maintain adequate soil moisture on unpaved haul roads to prevent visible dust emissions.
- Cover securely, or maintain at least 2 feet of freeboard on, all haul trucks when transporting materials.
- Prohibit all grading activities during periods of high wind (greater than 25 miles per hour).
- Plant vegetative ground cover in disturbed areas that are no longer needed for permanent facilities as soon as possible;
- Install wheel washers for all exiting trucks;
- Sweep streets if visible soil is carried onto adjacent public roads; and

- ♦ Post a publicly visible sign at the construction site to specify the telephone number and person to contact regarding complaints. This person would be responsible for responding to complaints and taking corrective action within 48 hours.

In addition, the following measures address minimizing O_3 precursor emissions:

- ♦ Maintain off-road construction vehicles so they meet the most stringent EPA NOx emission standards (currently 6.9 grams per brake-horsepower-hour).

- ♦ Properly maintain all equipment per manufacturers' specifications.

- ♦ Utilize alternative fuel equipment where feasible.

III.G.5.b. Mitigation of Air Quality Impacts

On June 17, 1999, the EPA approved the State of Arizona's plan for reducing fugitive dust from agricultural sources in the Phoenix area. This plan requires farmers to implement best management practices (BMPs) to reduce fugitive dust by December 31, 2001. The Governor of Arizona has established a BMP committee comprised of local farmers, State and local agencies, and universities to develop BMPs for submittal and approval by the State legislature. A program designed to educate the agricultural community on the requirements of the State plan would begin by June 10, 2000. These same or similar BMPs, if used in Pinal County, would facilitate reduction of potential PM_{10} emissions from agricultural activities in that County.